

POPULAR SCIENCE

NOVEMBER • 35c *Monthly*



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Comparing the 1957 Chevrolet Ford Plymouth



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PLYMOUTH

News and full-color photos
of 12 new cars, page 104



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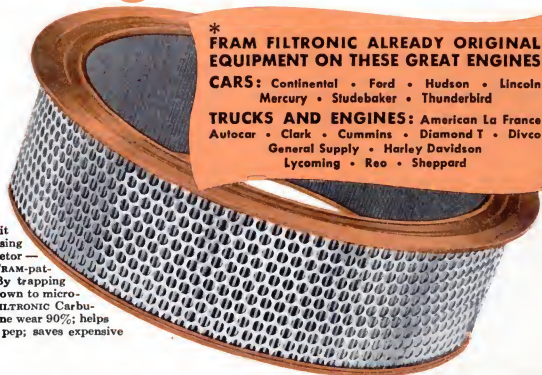
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NOVEMBER 1956 |

Popular Science Monthly

.....

November, 1956



A good, long look at the three most popular "low-priced" U.S. cars—with a feature-by-feature rundown on what each offers you for '57.



The amazing Propelloplane above is designed to rise up like a whirlybird, then level off for high-speed forward flight.

HIGHLIGHTS OF THE 1957 CARS:

A PICTURE GALLERY IN FULL COLOR • 104

Chevrolet • Plymouth • Ford • Dodge
Hudson • Nash • Rambler • Studebaker
DeSoto • Lincoln • Mercury • Chrysler

MORE AUTOMOBILE NEWS

- ◀ Comparing the Chevy, Ford, Plymouth • 113
What's New in the Chrysler Family • 120
The '57 Mercury: Longer, Wider, Lower • 124
Chevrolet's New Fuel Injection • 127

WORLD OF SCIENCE AND INDUSTRY

- ◀ Tilt-Wing Plane to Rise Like Copter • 100
The "Tin Goose" Is Flying Back • 130
How Safe Are Our A-Power Plants? • 134
Jets Will Fire World's Fastest Gun • 137
Mining Gasoline from Solid Rock • 166
The Machine That Indexed the Bible • 173

THE NEWS IN PICTURES

- New Arc Light Rivals Heat of Sun • 141
Subway Runs on Rubber Tires • 142
X-Ray Spots Flaws in Spinning Engine • 145
Talk-and-See Phones Closer to Reality • 147
Navy Rocket to Attack Enemy Subs • 148

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SPECIAL FEATURES

[Can There Be—Life Without Father? • 157](#)

[What Women Want in That "Next House" • 164](#)

[This Ship Died—but Lived Again • 168](#)

[How a TV Repairman Broke Up a Racket • 188](#)

[How to Choose the Right Hi-Fi Pickup • 214](#)



It can happen with turkeys (like little Olie above) but probably not with humans.

FOR THE HOME MECHANIC

[Gus Joins the Rescue Squad • 178](#)

[Better Blades for the Circular Saw • 183](#)

[Now You Can Spray Spatter Paint • 193](#)

[Parquet Floors from Wood Scraps • 197](#)

[Trouble-Shooting Fluorescent Lights • 200](#)

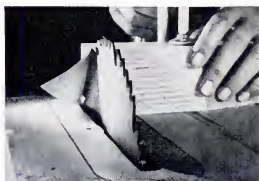
[Ready-Mades Make Built-in Easier Job • 205](#)

[New Seat Webbing Makes Repairs Easier • 208](#)

[You Should Try Chassis Punches • 209](#)

[Using the New Man-Made Boards • 219](#)

[Roll Out Those Storm Windows • 230](#)



This carbide-tip sliver slicer outlasts ordinary blades 100-1. It's one of many special saws you should know about.

WHAT'S NEW IN . . .

[Ideas from the Inventors • 161](#)

[Aids to Modern Living • 176](#)

[Handyman Products • 192](#)

[Car Accessories • 196](#)

[Shop Ideas • 206](#)

[Tools for Your Shop • 224](#)

EVERY MONTH . . .

[PS Readers Talk Back • 4](#)

[I'd Like to See Them Make • 10](#)

[Prize Projects by PS Readers • 12](#)

[Keeping the Home Shipshape • 14](#)

[PS Late News • 17](#)

[Hints from the Model Garage • 181](#)

[Wordless Workshop • 222](#)

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He'd Make Speeding Noisy

I HAD been thinking about speedometers when I came across a discussion in your Letters column in the March 1955 issue, which I saved to reread for its boats section. It appears to me that the ideal speedometer should:

1. Warn you when you are driving faster than a pre-decided speed;
2. Permit the owner (Dad) to pre-decide



the top speed to be driven by someone borrowing the car (son or daughter).

These functions could be achieved by a switch and key connecting the speedometer and the horn. For a superhighway the switch might be set at 55 m.p.h.—any time you went over this speed the horn would blow until you slowed down again.

When your teen-ager takes the car, you figure the route and decide on a top limit, say 45. You simply set the switch at 45 miles per hour and remove the key. If he speeds, there goes the horn.

This permits him all the power the car has for passing and emergencies, but makes it embarrassing to disobey your limit. So you sleep nights instead of worrying.

MICHAEL J. KOROSKYS, Dracut, Mass.

Upside-Down Planes Still Used

THAT very interesting article on old-fashioned tools [July, p. 139] says that the early colonists used their planes upside-down, and pushed the boards over them. Chinese woodworkers still do; the plane is equipped with four legs, and the man just pushes the board. The Chinese have an extra trick. For ordinary work, the plane "bottom" is

flat. But for cutting barrel staves, a dished plane with matching blade is used to make the staves bigger in the middle.

E. STORY HILDRETH, Brooklyn, Conn.

More on Snakes

I READ your article, "False Ideas About Snakes," [July, p. 134] with much interest, but there is one point I don't agree with.

You say that the tiger snake of Australia is the most poisonous. That notoriety properly belongs to another Australian snake, the taipan. Found in subtropical areas, it grows to a length of about 10 feet and has long fangs.

A taipan's bite is almost always fatal if not treated within seconds.

Tiger snakes are more numerous, so the total number of deaths from tiger-snake bites is higher than from taipan bites. But the percentage of deaths among those bitten by tiger snakes is only 40 percent; among taipan victims the percentage of deaths is 60 percent.

MICHAEL R. HARRIS,
Nowra, N.S.W., Australia

... I particularly enjoyed reading the July issue because of the excellent question-and-answer section on snakes by Clifford Pope. Interesting and truthful articles like Mr. Pope's help to show people that snakes are not repulsive, mysterious animals, but attractive, helpful ones which save the farmer



thousands of dollars yearly by destroying harmful insects and rodents.

Incidentally, the handsome, but unidenti-

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“held
back”

feeling?

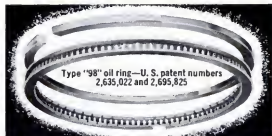


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NOVEMBER 1956 **5**

RICHARD MILNER, 1st Vice-President,
Reptile Club, Bayside, N. Y.

Would not the operation suggested in "Heel Makes Sharpening Pad," [Aug., p. 181] be quite dangerous? If the stake being sharpened should slip down off the rubber pad on the post, the hatchet could do quite a butchering job on the operator. A pad on the ground would be so much safer.

One of the features of your "I'd Like to See Them Make" column in September was a request from M. M. Carey of Newcastle,

Chrysler makes something very similar—a touch-up paint applicator that looks and operates like a fountain pen. If Mr. Carey would like to see them make it in person, I'd like to invite him to visit our MoPar plant the next time he is in Detroit.

COME again with that business about the radio star "Cygnus A" being two galaxies in collision 60 million light years from the earth ["90-Foot Eyes on Wheels Will Locate Radio Stars," July, p. 88]? This means that the signals picked up from Cygnus A left it 60 million years ago! Please pass the salt!

L. C. FLEISCHER,
Port Elizabeth, South Africa

The universe is an awfully big place. The closest star is the sun, and its light requires about eight minutes to reach us. There are only a few other stars close enough for their light to reach earth in less than 10 years' traveling time. Many

in Christmas Boxes



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stars are so far off that their light or radio waves must travel hundreds of millions of years before they can be picked up by astronomers. We know these stars, not as they are now, but as they were eons before the human race evolved.

The Volkswagen Is Roomy?

I'M GLAD Messrs. Luckett and Francis enjoyed their trip in the Volkswagen, as I knew they would ["Volkswagen Races 858 Miles. . ." Sept., p. 144]. In fairness to the VW's designer, though, it should be mentioned that climbing in tail-end-first is about as practical as entering a Continental through the window. I get my six-foot-three-inch frame in and out of my '55 VW in about 0.2 seconds with no special display of agility.

What's more, I can drive quite comfortably with a fedora on, an accommodation that is not offered by any of the current Detroit-mades.

JAMES VAN SICLEN, Queens Village, N. Y.

Associate Editor Francis reported: ". . . Luckett's getting aboard [the VW] was a production. He opened the right door,



backed onto the seat, scissored his legs and somehow got himself stowed in."

Smear or Erase?

THAT suggestion of George Stevenson for an eraser key on typewriters ["I'd Like to See Them Make," Aug., p. 60] couldn't work quite the way he proposed. If the tiny pad soaked in eradicator were clipped on a present key, it would merely discolor the ink on the typewriter ribbon, not eradicate the error.

W. J. WOODIN JR., Darien, Conn.

Mr. Stevenson's idea would work on those typewriters that have a lever for holding the ribbon out of the way of the type (used in cutting mimeograph stencils).

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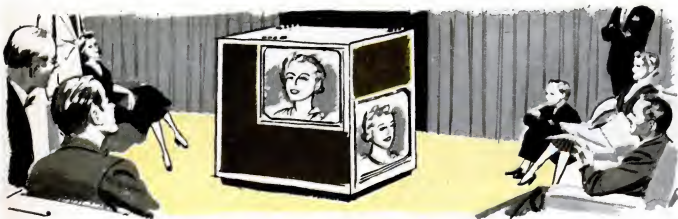
"I'd like to see them make..."



OIL-DRUM CONVERSION KITS for making cheap stoves for construction shacks and garages. When one drum gives out, fittings could be used on another.—*C. B. Casler, N. Westport, Mass.*

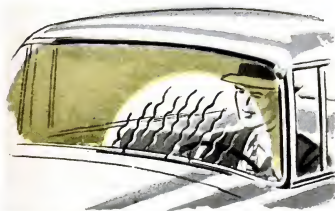


FLAT CANS OF DOG FOOD in several sizes. You'd only have to remove the lid and loosen the food with a fork. The can would serve as a dish.—*John Bainbridge, Old Forge, Pa.*

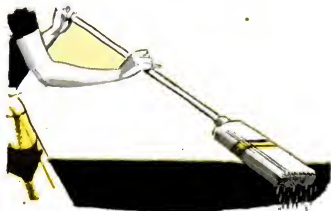


MULTIPLE-SCREEN TV SETS. Cabinets with screens at both sides as well as the front would do triple duty in hospitals, hotels, clubs and schools. And in the home, such a set would require less

rearrangement of the furniture. Mirrors installed within the cabinet could duplicate the picture from a single television tube for all-around viewing.—*Koriun Nagian, Los Angeles, Calif.*



OUTSIDE DEFROSTERS for car windshields, with engine heat passing through louvers fitted with baffles to keep out the rain or snow.—*Cpl. E. W. Birkholtz, Fort Monmouth, N. J.*



A DUSTLESS BROOM with a hollow handle of plastic that could be filled with water. Pressing a valve at the top would release the water for a clean sweep.—*Bill Uhase, Cleveland, Ohio.*

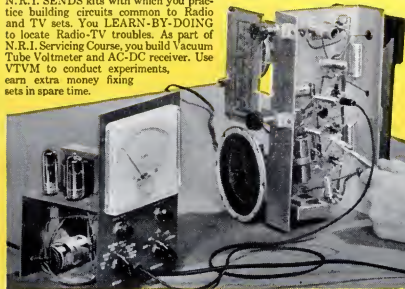
Everyone has his own pet idea of a gadget that he would like to see in general use. The five ideas illustrated above were suggested by POPULAR SCIENCE MONTHLY readers. What's

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Bigger than ever and still growing fast. That's why Radio-TV has special appeal to ambitious men not satisfied with their job and earnings. More than 4,000 Radio and TV stations. More than 150 million home and auto Radios, 40 million TV sets. Color TV promises added opportunities. For the trained man, there are good jobs, bright futures in Radio-TV Servicing or Broadcasting.

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NRI has trained thousands for successful careers in Radio-TV. Study fast or slow as you like. Diploma when you graduate. Mail coupon now. Paste it on a postcard or fill in envelope. **ACTUAL LESSON FREE**—so 64 page catalog that shows opportunities, shows equipment you get. Cost of NRI courses low. Easy terms. **NATIONAL RADIO INSTITUTE**, Dept. 6MB, Washington 9, D. C.

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"I was repairing Radios by 10th lesson. Now have good TV job." **M. R. LINDEMUTH**, Fort Wayne, Ind.



"Doing spare time repairs on Radio and TV. Soon servicing full time." **CLYDE HIGGINS**, Waltham, Mass.

"I had a successful Radio repair shop. Now I'm Engineer for WHPE." **V. W. WORKMAN**, High Point, N. C.



"There are a number of NRI graduates here. I can thank NRI for this job." **JACK WAGNER**, Lexington, N. C.



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Prize Projects BY PS READERS



Giant Globe Maps Earth. Almost 15,000 hours of his spare time have gone into this five-foot sphere, constructed by Ludwig Krün, a carpenter of Kempten,

Germany. He believes it is the world's largest wooden globe showing our earth in relief. After carving wood pieces to give exact elevations, he nails them on.



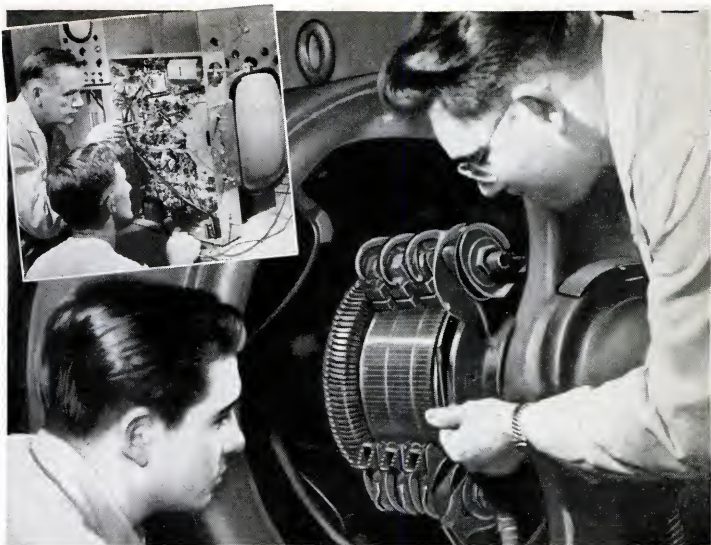
Hidden Axle Lowers Trailer. Planning a walk-in camp trailer with only a 10-inch ground clearance, B. T. Smith of Lubbock, Tex., needed working room for its axle and spring. So he ran them right through the aluminum trailer's body and built a box seat over them.



Boy's Coil Challenges Gravity. This repulsion coil built by 13-year-old Ronald Limburg of Pittsburgh, Pa., is shown holding an aluminum ring in mid-air against the pull of gravity. It won the junior-division first prize at the 1956 Buhl Planetarium School Science Fair.

Have you recently completed a workshop project of which you are particularly proud? Send a good photograph of your work, along with the negative and a brief description,

to POPULAR SCIENCE MONTHLY's Mechanics and Handicraft Editor, 353 Fourth Ave., New York 10, N. Y. We will pay \$15 for each item that is accepted for publication.



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Address.....

City.....State.....

NOVEMBER 1956 13

Keeping the Home Shipshape



FOR A WARMER GARAGE, seal the sides of the door with tubular weatherstripping. Fix the tacking lap to the casing so that the strip fits tight against the outside of the door.



TO STRIP OFF WASHABLE WALLPAPER, go over it first with coarse sandpaper. This will break down the nonabsorbent surface so that water can soak through to loosen the paste.



PLUG IN THE HEAT LAMP to crisp cereals and crackers, heat up rolls, or soften butter for spreading. Use it, too, to warm cold plates or to keep a filled plate hot for a late comer.

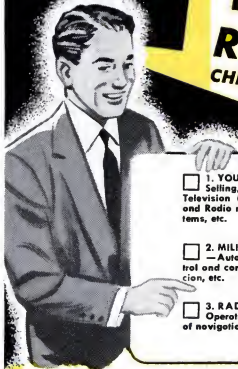


A STORM CLOSET will give you a place for wet clothing. Put a grille in the door, form a sheet-metal pan to fit the floor, and hang a wire shelf above it to hold boots and rubbers.



SECURE A GARBAGE-CAN LID with a coil-spring curtain rod, and high winds or prowling cats won't budge it. Hook the ends over the handles, closing one hook to anchor spring to can.

**LOOK
THEM
OVER!**



**A wide variety of opportunities
awaits the Trained Man in the
Fast Growing Fields of**
TELEVISION
RADIO • ELECTRONICS
CHECK THESE OUTSTANDING OPPORTUNITIES!

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tems, etc.
- ☐ 2. MILITARY ELECTRONICS
—Automatic weapons control
and communications techni-
cian, etc.
- ☐ 3. RADAR TECHNICIAN—
Operation and maintenance
of navigation devices, etc.

- ☐ 4. TV-RADIO BROADCAST-
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tral room operator, TV camera-
man, FCC licensed operator.
- ☐ 5. INDUSTRIAL TELEVISION—
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icing of closed circuit TV systems.
- ☐ 6. AIRCRAFT RADIO—Flight
tester, control tower oper-
ator, radio operator.
- ☐ 7. AUTOMATION ELEC-
TRONICS—Specialist on
electronic instruments and auto-
matic controls.

- ☐ 8. TWO-WAY RADIO—Op-
eration and maintenance of
police, taxi, bus, truck commu-
nications systems.
- ☐ 9. REMOTE CONTROLS—
Laboratory specialist on
servo-mechanisms, guided mis-
siles, radio-controlled devices.
- ☐ 10. COMPUTERS—Install
and maintain Electronic
"Brain" devices for office and
industry.

... PLUS MANY OTHERS

Scores of jobs like those above in the technical end of Television-Radio-Electronics are open to men with proper training. Hundreds of DeVry graduates held jobs like this. Many prepared at home and then we helped them get started. Hundreds had no previous technical training, no high school diploma, and while training never left home nor quit their jobs. Many were married men. Some paid for their training by repairing TV and Radio sets in their spare time.

DTI's program helps you do this because it is different. You get on-the-job type experience, clear explanations. You build and keep your own test equipment, as you perform over 300 practical projects. You use visual training HOME MOVIES and the remarkable Electro-Lab. You may even build a fine quality 21-inch Television set, if you wish.

TRAIN IN OUR WELL-EQUIPPED LABORATORIES

If you prefer, you can get all of your training in our great Chicago Laboratories. Friendly, capable instructors work closely with you, as you learn about the commercial equipment you encounter later in the field. Students use this fine equipment, including the broadcast-type cameras, monitors, microphones, etc. in our TV-Radio studios ... the color TV sets ... the test instruments, etc. Send coupon for details.

EMPLOYMENT SERVICE

Placement is the "payoff" in any training program. We have close contact with many employers in our field. We are proud of our graduates—for they have done us proud! That's why we believe we can help you get started. And if you are thinking of going into business for yourself, we help you there too.

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We have valuable information showing how to make the most of your service in the Armed Forces. Mail the coupon.

HOME MOVIES

We loan you a projector and many reels of instructive film. Run them off yourself. How clear the basic principles of Electronics can be with this helpful training aid ... a DTI exclusive!



EXCLUSIVE ELECTRO-LAB®

Wiring diagrams show up through the transparent base. You follow each diagram, making scores of circuits. Parts are mounted quickly ... easily with spring clip connectors. Over 300 projects include the building of a 5-inch Oscilloscope and a Vacuum Tube Voltmeter ... both valuable test instruments.

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TUBE
VOLT-METER



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I would like a copy of "Electronics and YOU" showing many opportunities in Television-Radio-Electronics, and how DTI may prepare me for a start in this billion dollar field.

Of the opportunities listed above, I am interested in No. _____

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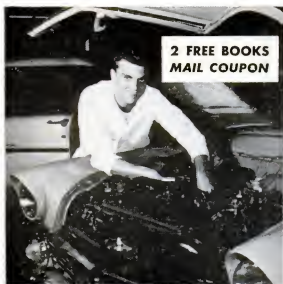
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CTI Shop-Method training is so practical you take on repair jobs with confidence long before you graduate. After just a few lessons, many students do repair work in their communities. Their earnings often pay tuition, buy equipment, and start some in a full-time business. You, too, can make up to \$5 an hour while training, and get valuable experience besides.

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If you like independence, Auto Mechanics can make your dream come true. Start in your own back yard as you train and rent a building when you have a large enough list of satisfied customers. Or, work in a local repair shop, make friends, and in time begin "on your own." Graduates have opened shops with just a few hundred dollars.



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So complete is CTI training in Auto Mechanics that you become not just a mechanic but a *specialist* in tune-up; overhaul; automatic transmissions; power steering; power brakes; clutches; electric, cooling and lubricating systems; etc. And that isn't all! If you wish, CTI will send you instruction on either Diesel Mechanics or Body & Fender Rebuilding at no extra cost.

High Praise From Industry

One of the largest auto trade associations in America said: "CTI has the best school in the U.S.A." Another association reported: "Your graduates are making excellent progress . . . are highly thought of."

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Mail me your book *Big Money In Auto Mechanics* and Lesson Sample. Both FREE.

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A NATIONAL MAGAZINE reports that an auto mechanic has the "brightest future" . . . that his prospects for success are "very good" . . . that he has "opportunity to open his own shop." This is no surprise because Auto Mechanics ranks as America's No. 1 trade. *It offers you good pay, lifelong security and steady work.* Here's why: There are 600,000 auto repair shops and supply stores in the U.S. These shops need thousands of trained mechanics to keep the 50 million cars and 10 million trucks on the road in operation. As a leading automotive magazine said: "About two-thirds of all cars in use are in the heavy repair age classification." It adds, "Aside from the prosperity generated by the huge flood of new cars, the service potential they create is tremendous." If YOU are a man of action—if you want to earn up to \$125 a week and more—we suggest you mail coupon below for two new, free books. These books tell you about the good jobs now waiting . . . show you how to qualify at home in spare time in just a few months.

You Get Practical Experience Using Tools and Tune-Up Kit

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As part of your training, CTI sends you this set of fine quality mechanic's tools. You'll soon be using these tools—getting practical experience and earning spare time dollars, just as many students do. Tools make you proud of your craft, keep your interest high, develop your skill. CTI's illustrated, easy-to-understand lessons show you when and how to use your tools. You will put action into your training—see your knowledge "come alive."



Only CTI Sends This Tune-Up Kit

The experienced mechanic depends on instruments to help him locate engine troubles quickly. As a student of CTI—and only CTI—you enjoy this advantage too. We send you this professional kit of essential instruments. It includes a Compression Tester, a Vacuum Gauge and Fuel Pump Tester, an Ignition Timing Light, and a portable test case. These instruments are well constructed, compact and accurate . . . products of a famous manufacturer. Thus, CTI offers you *better training, more kits.*



Mail Coupon: Get Facts On Jobs and Training

Vocational experts say that jobs are more secure and pay is higher in the old, established industries. The automotive field is one of the oldest, the largest, the most prosperous (look at auto sales!) You just can't pick a better trade than Auto Mechanics. Prove to yourself that this trade is *best for you*: Fill out and mail coupon below to Commercial Trades Institute, 1400 Greenleaf Ave., Chicago 26—and we'll send you the facts.

MAKE GOOD LIKE THESE CTI MEN



"Without CTI training, I would not have the job I hold today. When I showed my CTI diploma, I was given a chance to work as a mechanic."
—W. O'NEIL, PA.

"Have bettered myself nearly 100%. Am in partnership with another fellow and we have 24 cars of our own."
—A. H. CATES, ME.



"Went to work in a garage repairing generators, starters, other electrical equipment. Training is complete and thorough."
—J. EDWARDS, ILL.

"After completion of training, I started as a full-fledged mechanic in a Buick garage."
—W. CARTWRIGHT, IND.

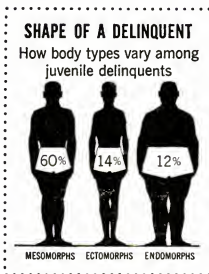
"Have had 3 pay raises in 8 months. Before I took the course, I knew very little about a car engine."
—W. LONO, PA.

Late News

.....

The first electrical highway is now abuilding in, of all places, Greenland. Two parallel wires are being buried in the snow across 100 miles of Arctic ice cap to keep the Army's big Weasel tracked vehicles from wandering off the trail and falling into crevasses. The wires will carry alternating current, which, detected by a receiver aboard the Weasel, will tell the driver where he is between the trail wires. An alarm will go off if he crosses a wire.

Can you tell a juvenile delinquent just by looking at him? Maybe, say Professor Sheldon Glueck and his wife, Dr. Eleanor Glueck, of Harvard Law School. But if your image is a furtive, sallow, underweight youth, you're wrong. It's the All-American Boy, the muscular, athletic type who is most likely to run into cop-trouble.



The Gluecks' latest report analyzes a group of 500 delinquent boys by body build. The result: 60 percent were found to be the athletic "mesomorph" type; 14 percent were the more delicate, slimmer "ectomorphs"; 12 percent were the softer, rounder "endomorphs"; the remainder were a mixture of the three types. By comparison, a similar group of 500 non-delinquent boys included 30 percent mesomorphs, 40 percent ectomorphs, and 15 percent each of endomorphs and balanced types. Physique does

not cause mesomorphs to go wrong. But it may make trouble more likely. If they can't find action that is socially acceptable, such as sports, they blow off steam the wrong way.

Protection against grippe seems to be at hand. A new vaccine developed by the Public Health Service was tried last winter on 4,000 recruits at the Naval Training Center in Great Lakes, Ill. Fifty to 70 percent of "respiratory illnesses characterized by fever" were prevented. Only one shot was needed. The new vaccine works against only three types—those most common among young men—of 13 known "adenoviruses." The vaccine doesn't help at all with the common cold, which is another breed of bug.

Legal tangle in the sky. Suppose you're flying in a British airliner over France. Where are you? Some countries, including Britain, would claim that you are in Great Britain, other countries, including France, would say no, you are in France. A new attempt to straighten out such mixups was made this fall by international aviation experts, who have been puzzling over the problem since

Late News

1912. The point is not academic: Babies are born, crimes committed, and wills written in airplanes. A baby born aboard a British plane over France could choose either British or French citizenship. But a baby born aboard a French plane over Great Britain would be a child without a country unless it derived citizenship from its parents. The French would say that the birth took place in Britain. The British would say it occurred in France. Criminal possibilities are even more intriguing—a defense lawyer would try to switch trials to the country with easiest laws.

What should foreign words mean? You may be able to guess—and come out right—reports Dr. Roger W. Brown of Harvard. Try it on the list at left, which was selected from a group of Chinese, Czech and Hindi words that Dr. Brown tested on 80 students. The Har-

vard men, who knew only English, guessed right about 60 percent of the time when asked to match a pair of opposite-meaning foreign words with the equivalent English. In one case—matching “heavy” and “light” to the Chinese “ch’ing” and “ch’ung”—they scored 93 percent. (Ch’ing means light.) Dr. Brown explains that the students agreed on their translations, right or wrong, because of “a shared notion, a cultural conception, of what certain sounds usually mean in English.” But he doesn’t understand why they were so often correct. And when he tried the same kind of test on 20 Chinese who spoke no English, he got fewer correct translations.

What's This Mean?

One word in each of the pairs below means beautiful; the other word means ugly. Can you guess which is which? Answers at bottom.

| | |
|----------------|-------------------------------|
| CHINESE | Mel Ch'ou |
| CZECH | Krasa Osklivost |
| HINDI | Badsurat Khubsurat |

*Mc, Krasa and Khubsurat mean beautiful.
Ch'ou, oskivost and badsurat are ugly.*

Short takes. The all-aluminum auto engine—lighter, cheaper, sturdier—came closer to practicality with the development of a new method for spray-coating aluminum cylinder walls with steel. Aluminum pistons, now in use, don't work well bearing directly against aluminum cylinder walls, but will work against steel surfaces. The problem has been getting thin steel to stick to aluminum . . . You'll be able to hunt this fall with comfortably dry feet if you get a pair of the new boots made with silicone-treated leather. The silicone blocks water but not air. Dow Corning developed the Sylflex process . . . A new Admiral Corp. radar speed meter can be set to watch only cars exceeding the speed limit, to work a camera or tape recorder, and even to make a traffic light down the road turn red and halt the speeding car . . . You can look forward to an evening of delightful nostalgia with “Trolley Car Treasury” (McGraw-Hill N. Y., \$5.95), the new book by Popular Science's Frank Rowsome Jr. It has wonderful old photos—horse cars, cable cars, trolley Pullmans, trolley hearses and trolley wrecks—and a text deliciously spiced with Rowsome wit.



80 TIMES AROUND THE WORLD — AND NOT A SINGLE BATTERY FAILURE !

Test Proves Auto-Lite Sta-ful Finest Battery Money Can Buy

Auto-Lite engineers set out to see just how much punishment Auto-Lite Sta-ful Batteries could really take. Not in limited laboratory tests, but in actual "on the road" tests under the most extreme conditions. Here's a report on those tests. For 25 months (and over 2 million miles) these batteries were punished in desert heat and below-zero cold, in short city runs, and coast-to-coast trips in the United States and Canada.

FINAL RESULT: Not one single battery failed! After 2 years' continual use, 95% gave better cold-weather starting than required of new batteries. The test also proved that Auto-Lite Sta-ful Batteries need water only 3 times a year in normal car use. For a battery that gives long life and quick, sure starts, get a road-tested, road-proved Auto-Lite Sta-ful. For only a few pennies a month more you can have the *finest*.

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6 or 12 Volts



AUTO-LITE

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Needs water only 3 times a year*

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NOVEMBER 1956 19



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Be careful before you answer. GENIAC the first electrical brain construction kit is equipped to play tic-tac-toe, cipher and encipher codes, convert from binary to decimal, reason in syllogisms) as well as add, subtract, multiply and divide. Specific problems in a variety of fields—actuarial, policy claim settlement, physics, etc., can be set up and solved with the components. Connections are solderless and are completely explained with templates in the manual. This covers 33 circuits and shows how new ones can be designed.

You will find building and using GENIACS a wonderful experience; one kit user wrote us: "this kit has opened up a new world of thinking to me." You actually see how computing, problem solving, and game play (Tic-tac-toe, nim, etc.) can be analyzed with Boolean Algebra and the algebraic solutions transformed directly into circuit diagrams. You create from over 400 specially designed and manufactured components a machine that solves problems faster than you can express them.

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INVENTORS



Learn how to protect your invention. The U. S. Patent Laws provide that any new and useful art, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof, may be patented if the act of invention is involved. Therefore, every inventor with a valuable invention should take advantage of the Patent Laws and proceed for patent protection in order to safeguard his rights.

A patent gives the inventor the exclusive right to prevent others from making, using, or selling the invention claimed in the patent for a period of seventeen years.

The Patent Laws were enacted for the benefit of the inventor to give him protection for the features of his invention which are patentable. These features must be properly and concisely set forth and claimed in a formal application for patent, in order to comply with the requirements of the Patent Laws. For that reason, unless the inventor is familiar with patent matters, he should engage a competent registered patent attorney or agent to represent him. We are registered to practice before the U. S. Patent Office and are prepared to serve you in the handling of your patent matters.

A specially prepared booklet entitled "Patent Guide for the Inventor", containing detailed information with respect to patent protection and procedure, together with a "Record of Invention" form will be promptly forwarded to you without obligation upon request.

CLARENCE A. O'BRIEN & HARVEY JACOBSON

Registered Patent Attorneys

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Better Pay—More Opportunities

Get into a field where there is important work and opportunity for the trained man. Millions of electric appliances are sold every year. Every wired home now has an average of 8. Many of them need service and repair. Owners pay well to have them fixed quickly, properly. This is your opportunity for a better job, your own part time or full time business. NRI can give you the training you need, at home, in your spare time.

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Soon after starting you will be able to earn extra cash fixing toasters, clocks, fans, vacuum cleaners, etc., for neighbors and friends. Keep your job while learning and earning. Put spare time to work for you. Work in your basement, garage, spare room. You'll be amazed how easily, quickly you, too, can start earning many extra dollars. NRI shows you how. Even before you finish training your spare time earnings may pay for the course and equipment.

NRI Sends Tester to Learn and Earn

You need proper equipment to service today's automatic appliances. With this course you get parts to build professional type, multi-use Appliance Tester. You learn to use it. Takes guess work out of servicing. Mail coupon for FREE book and Sample Lesson. See how easy it is to learn. Find out about NRI—a school that for more than 40 years has been training men, through home study, for success, good pay jobs. Our reputation, record, experience back up this course. Write now to: Electric Appliance Training, NRI, Dept. BM6, Washington 9, D. C.



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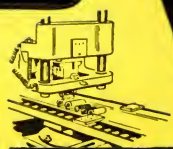
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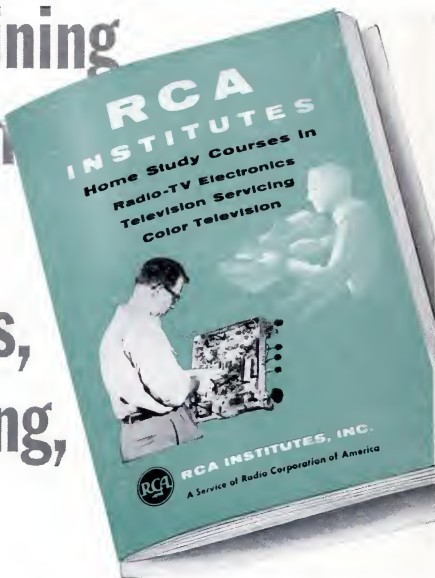
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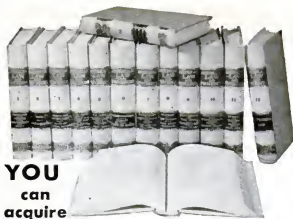
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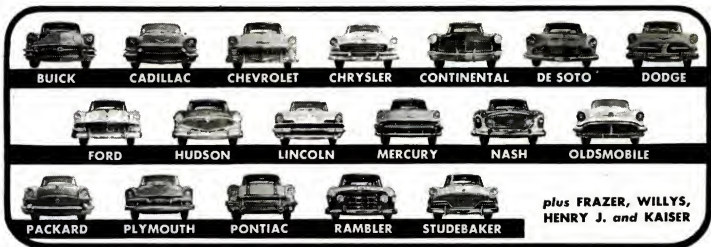
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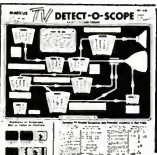
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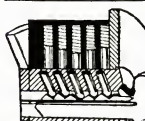
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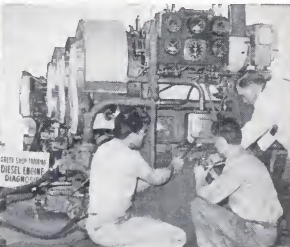
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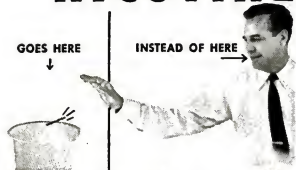
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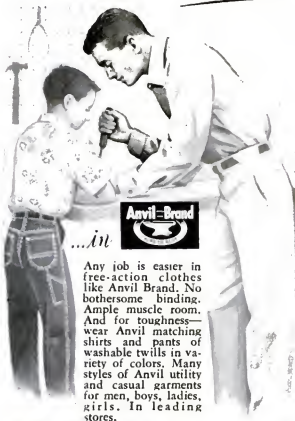
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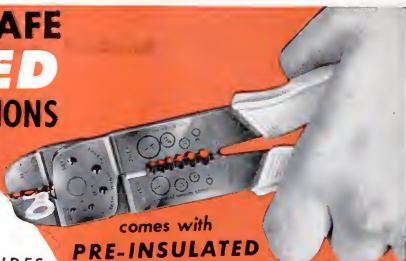
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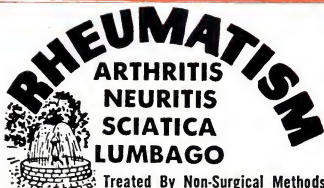
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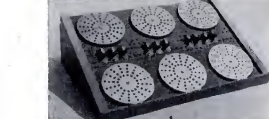
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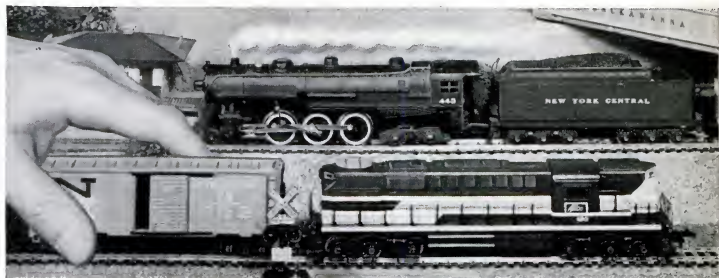
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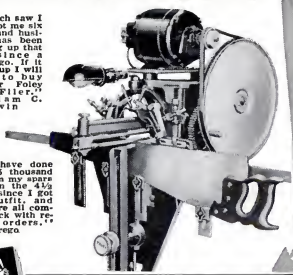
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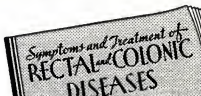
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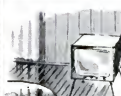
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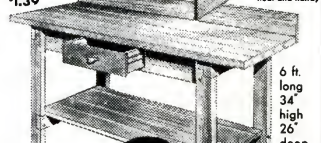
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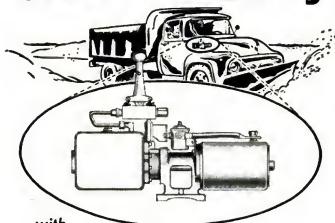
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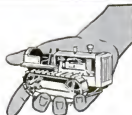
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| | |
|---|-----|
| Advertising, Agencies for Advertisers..... | 53 |
| Agents Wanted..... | 53 |
| Antiques, Relics & Indian Goods..... | 58 |
| Artists Supplies..... | 59 |
| Authors Service..... | 52 |
| Auto Trailers & Equipment..... | 3 |
| Automobiles & Midget Cars..... | 1 |
| Aviation..... | 5 |
| Batteries, Generators, Etc..... | 6 |
| Boats, Outboard Motors..... | 11 |
| Body-Building Courses, Jiu Jitsu, Etc..... | 12 |
| Books & Magazines..... | 23 |
| Build It Yourself..... | 60 |
| Business Opportunities..... | 59 |
| Business Service, Information, Name..... | 5 |
| Buy It Wholesale..... | 38A |
| Cameras, Photo Supplies..... | 34 |
| Camping Equipment & Tents..... | 12 |
| Cartooning, Sign Painting, Chalk Talks..... | 23 |
| Chemistry & Physics..... | 54 |
| Coins & Currency..... | 66 |
| Color Photo Finishing..... | 52A |
| Contents..... | 46 |
| Detective..... | 47 |
| Dogs, Birds, Hamsters & Pets..... | 17 |
| Earthworms..... | 18 |
| Educational & Instruction..... | 45 |
| Electrical Supplies & Equipment..... | 10 |
| Engines, Motors, Etc..... | 15 |
| Farms, Other Real Estate..... | 19 |
| Field Glasses, Telescopes..... | 60 |
| For Investors..... | 24 |
| For Sale Miscellaneous..... | 71 |
| For the Home..... | 39 |
| Formulas, Plans, Etc..... | 39 |
| Games & Entertainment..... | 24A |
| Geiger Counters, Treasure Finders..... | 77 |
| Help Wanted..... | 42 |
| Hobbies, Collections..... | 31 |
| Home Craftsmen..... | 65 |
| Humorism..... | 64 |
| Inventions Wanted..... | 21 |
| Language Outlets..... | 48 |
| Machinery, Tool Supplies, Etc..... | 9 |
| Magic Tricks, Puzzles, Etc..... | 25 |
| Manufacturing..... | 13 |
| Minerals & Precious Stones..... | 30 |
| Model..... | 64 |
| Model-Model Supplies..... | 64 |
| Money-making Opportunities..... | 38 |
| Motor Pictures, Slides, Sound Equip..... | 35 |
| Motorcycles, Bicycles & Supplies..... | 4 |
| Razor Blades, Shavers..... | 74 |
| Of Interest To Women..... | 70 |
| Old Gold, Jewelry, Watches..... | 67 |
| Old Stamps Wanted..... | 27 |
| Patent Attorneys..... | 59 |
| Patents For Sale..... | 82 |
| Personal..... | 80 |
| Photo Finishing, Photocopies, Etc..... | 52 |
| Play, Stages, Etc..... | 40 |
| Poultry & Supplies..... | 21 |
| Printing, Multigraphing, Etc..... | 58 |
| Printing Outlets, Supplies..... | 52 |
| Profitable Occupations..... | 22 |
| Radio, TV, Supplies & Equipment..... | 36 |
| Razor Blades, Shavers..... | 74 |
| Rubber Stamps & Office Supplies..... | 56 |
| Special Services..... | 51 |
| Sporting Goods, Guns, Fishing Tackle..... | 15 |
| Stamp Collecting..... | 28 |
| Tattooing Supplies..... | 75 |
| Tobacco & Pipes..... | 68 |
| Typewriters, Rooms & Hotels..... | 70 |
| Typewriters & Office Machines..... | 55 |
| Wanted To Buy..... | 72 |
| Watch Repairing..... | 78 |
| Wearing Apparel..... | 73 |
| Welding, Soldering..... | 8 |

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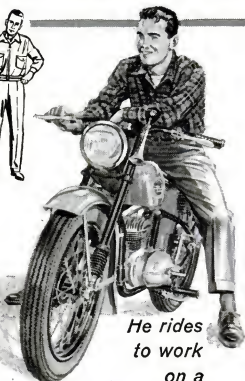
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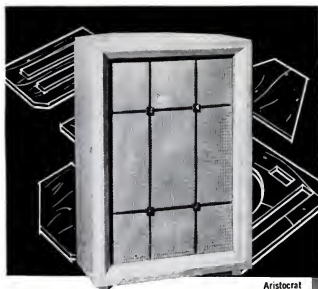
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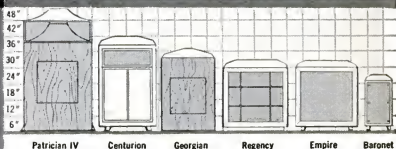
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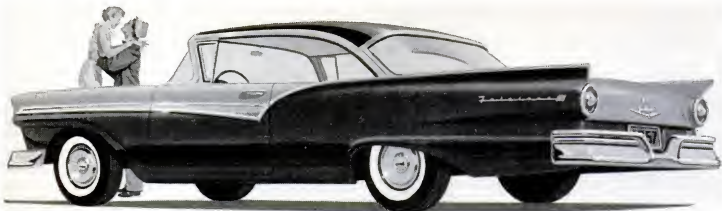
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What put the magic in

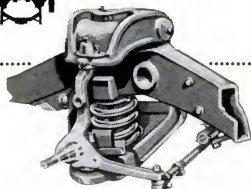
The big news from Detroit this year is the magic of the "Inner Ford" for '57. The magic begins with a bow-shaped frame that sweeps out and dips down between the wheels. Side rails flare out almost 13" further than in '56. Passengers are within (but still above) the contour of the frame.

Side rails thus serve as concealed "side bumpers" of immense strength. This new contoured frame provides the '57 models with the most rugged foundation of any Ford yet.

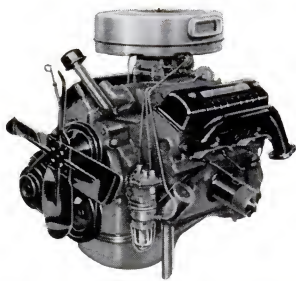
Ford's new sculptured-in-steel body is secured to this rugged frame by 20 unique



The contoured frame is a ladder-type structure with heavier box section side rails and 5 cross members. Torsional rigidity of this '57 frame is as much as 27 per cent greater.



4-way ball-joint front suspension has been further advanced. New lower suspension arms are swept back so front wheels step over bumps rather than *into* them . . . a 4-way action for a softer ride.



The magic of the Ford Silver Anniversary V-8's for '57 is centered about the words "deeper breathing." New larger intake valves, king-sized manifolds, and higher lift camshafts help provide a larger volume of fuel-air mixture, thus allowing for superior engine performance . . . up to 245 hp. The popular Mileage Maker Six, the most advanced Six in the industry, has been boosted to 144 hp.

FORD Division of



the new kind of FORD?

live-rubber body mounts. This helps the '57 Ford to give you the solid, silent kind of ride you expect to find only in more expensive cars.

There's magic in three high-performance Silver Anniversary V-8's with up to 245 hp. The new low silhouette carburetor and

higher compression combustion chambers are just a few of the new V-8 engine features that you'll appreciate.

See your Ford Dealer soon. He'll gladly give you the full story of Ford magic for '57, and let you action-test this *new kind* of car with the Touch of Tomorrow.



Even-keel rear springs are longer-leaved and out-board mounted for wider stance, greater stability.



New deep-offset hypoid axle has exclusive straddle-mounted pinion for greater torque capacity, quieter operation and longer life.



Carburetors are low silhouette type. They give a more homogeneous mixture for better starts.



Air cleaner used with Ford's new carburetor has re-usable pleated fibre filter; offers easier maintenance and more filtering area.



Centrifugal-vacuum distributor for V-8's has long-lived ventilated points. Breaker plate rotates on full ball bearings for split-second response to changing engine requirements.

FORD MOTOR COMPANY



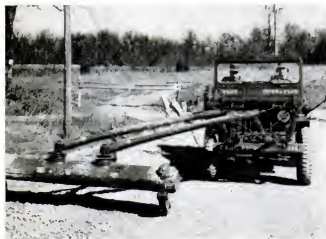
Cart Climbs on Crossed Wheels

A HEAVY can or a piece of furniture goes up and down stairs easily on this British cart with four rubber-tired wheels on each side. The crossed arms tip forward on each step to rest the next set of wheels on the higher or lower level.



Amplifier Eavesdrops on Pilots

A DROP of a coin lets air travelers and visitors hear what goes on between pilots and the traffic control tower at the Oakland, Calif., airport. Just insert a dime in the slot and the "listening post" amplifies the two-way conversation.



Mine Stops Jeep in Its Tracks

A MOBILE mine detector developed at Fort Belvoir, Va., stops the jeep it rides if it locates a mine. When the search coil signals danger, a spring-loaded, hydraulically operated piston disengages the jeep's clutch and sets the brake.



Giant Feed Bag for Earth Mover

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EQUAL TO A V-12 IN SMOOTHNESS! Naturally, a 6-cylinder 2-cycle engine has the same number of firing impulses per revolution as a 12-cylinder 4-cycle V-12! Mercury's famous Full-Jeweled Power* guarantees smooth power longer, too!

*Anti-friction ball and roller bearings throughout.

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2. New 10 h.p. Mercury for super-slow trolling!

NEW MARK 10 TROL-TWIN



● The new Mercury Trol-Twin was designed expressly for fishermen! New glide-angle underwater structure slides smoothly over stumps, rocks and through thickest weeds, puts cylinders at their best idling angle for hours of slow trolling. Single lever control . . . throttle, neutral and reverse all on one-hand control. Big displacement for power to plane your boat . . . get fishing fast.

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Twist the tiller handle for speed. Twist again for neutral or reverse. One control does everything.



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350-M.P.H. Tilt-Wing Transport to Rise Like a Copter



With props pointing skyward, it would be a whirlybird for takeoff and landing, then become an airplane for forward flight.



By Wesley S. Griswold

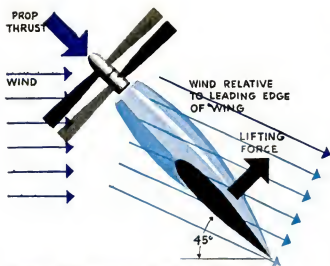
THE aircraft company that cooked up the "flying piepan" now has designed for the U. S. Army a big air transport that will go straight up like a copter, then streak away like a DC-7.

It's not a helicopter. It's not an airplane, as such. Yet it's both. The tilt-wing Propelloplane, as this extraordinary craft is called, was designed by Hiller Helicopters of Palo Alto, Calif. It would carry 40 to 50 fully equipped troops, or several small vehicles, or a big load of military supplies many hundreds of miles at nearly three times the speed of the fastest helicopter. Yet it would be able to pick up and set down its cargo on any small, flat patch of ground. It would cruise at 350 m.p.h., but land at zero m.p.h.

This versatility would be accomplished by an otherwise conventional wing that would tilt 90 degrees for vertical, straight-up-or-down, takeoffs and landings. Tilting with the wing would be four large, six-blade, contrarotating propellers and their high-powered turboprop engines.

Drawings, based on an exhaustive study made under contract for the Army, indi-





How tilt-wing helps lift plane

UP-ENDED WING, even when it is tilted a full 90 degrees, contributes to lift by deflecting slipstream from the propellers, as shown in the sketch above, drawn by a Hiller engineer.

.....

cate that it would have the fat belly and high tail of most military transports with rear, ramp-loading facilities, and a bulbous nose for radar equipment.

In each of the four nacelles there would be at least two and possibly three gas-turbine engines, parallel or in a cluster. They would develop a total of around 20,000 horsepower.

Multiple-section engines—their technical name—make it possible to dispense with tricky interconnecting shafting, which otherwise would be essential to provide safety and sure control when the convertiplane was hovering.

In practice, on takeoff, the two or three engines in each nacelle would be operating at around two-thirds power. If one of them failed, the other, or others, would then be operated at full power to make up for the dead partner.

The Propelloplane's wing would be conventional, or even slightly smaller than normal, in span and shape. In forward flight, the only feature of it that would compel your attention would be two huge fuel tanks, slung from underneath the wing, one on each side of the fuselage. These tanks would carry the plane's entire fuel supply.

At takeoff or landing, however, the wing's appearance would be both unique and startling, for it would be standing

on edge, with engines, propellers and fuel tanks pointing straight up. This would be done by rotating the wing on pivots fastened to the lower flange of the wing's rear beam. Ball-bearing screw jacks, operated by a hydraulic motor, or a pair of hydraulic cylinders, would move the wing. In order to make room for the middle part of the wing to be laid back against the fuselage, a panel in the skin of the roof directly behind the wing would first be lifted out of the way hydraulically. Once the wing was rotated back to its normal position, this panel would be closed, so as not to spoil the streamlining of the fuselage.

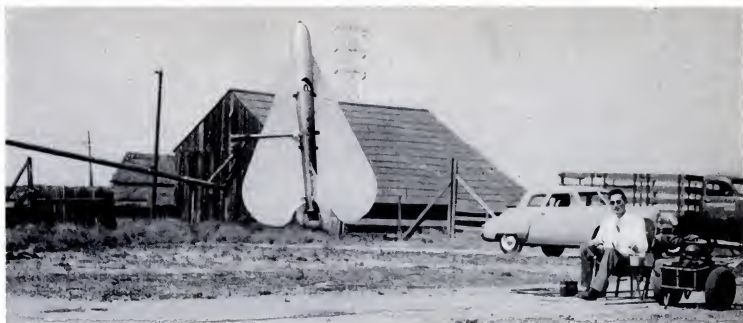
One unusual feature would be visible all the time but useful only when the craft was hovering, moving slowly, or landing or taking off vertically. That is an exceptionally long tail cone with a projectile-shaped tip, slotted with deflector vanes. Those vanes are intended to direct downward, upward or horizontally the exhaust from two or more turbine engines. These exhaust gases, deflected downward or upward, would control pitch; deflected horizontally they would control yaw.

Imagine how useful the tilt-wing Propelloplane would have been in a typical crisis of the Korean War. Assume that 40 infantrymen have been isolated 400

.....

SMALL VERSION of the Propelloplane, having only two engines and props in its tiltable wing, also is under consideration. Pitch and yaw would be controlled by small tail rotors, as seen in the drawing. This would be an alternate to using deflected exhaust gases.





NINE YEARS AGO Hiller began his vertical-riser experiments with this captive, jet-powered,

delta-wing research model that he is shown flight-testing by means of a whirling arm.

miles from their own troops. That's more than three times as far as rescue helicopters can fly.

A Propelloplane is ordered to the rescue. It takes off, rising straight up. Then, with fuselage still level, the wing is tilted forward into conventional position. It speeds toward the encircled troops, flying high and fast enough to offer a poor target for enemy anti-aircraft fire. As it approaches the stranded soldiers, it descends to a low altitude. Its wing starts to tilt upward. Speed drops sharply. When the wing is 45 degrees from the horizontal, speed is only 75 miles an hour. As the slant of the wing steepens, the craft's speed slackens until it is standing still, hovering for an instant. Then it comes down out of the sky like an elevator. Its rear doors open and the troops scramble in. Within a few minutes, the plane rises straight up above the trees and starts homeward with increasing speed as its wing is lowered from the vertical position.

In addition to this obvious usefulness, the Propelloplane, its designers say, could keep troops in isolated combat areas supplied at less cost than with helicopters of comparable capacity. It could operate efficiently from areas where there was not enough space or time to build the long runways necessary for con-

ventional transport takeoff and landing.

"Vertical-takeoff aircraft won't replace or squeeze out helicopters," predicts shrewd, handsome young Stanley Hiller Jr., who has been experimenting with VTO aircraft designs for nine years and building helicopters for longer than that. "They complement each other."

"For hovering missions," he continues, "nothing can beat the helicopter. But now, for the most part, it is being improperly used, devoted about 98 percent of the time to missions requiring it to fly horizontally. For such jobs, it is not economical."

The tilt-wing Propelloplane, on the other hand, he points out, would hover only for takeoff and landing, utilizing power plant, transmission and propellers designed for general use, with far fewer problems of maintenance and parts replacement than helicopters involve. Most of the time it would be flying forward, a job to which it is as well suited as most conventional transport planes.

The small penalty that the Propelloplane would have to pay in weight for power enough to lift and lower it vertically is not entirely a liability. Whenever it was practical for it to take off as a conventional airplane, that extra power would enable it to carry double its normal payload.

END

12 New Cars

Popular Science's color gallery gives you the highlights on the 1957 models

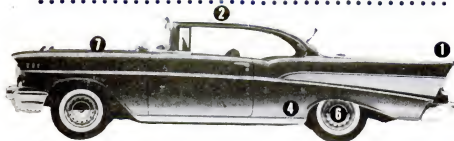


Ever see a junior-size Cadillac? That's the '57 Chevy convertible. Above it is the hardtop.

Chevrolet: Fuel Injection

If Louis Chevrolet could only see his brainchild now! That born-to-the-purple look isn't just skin-deep, either. Underneath it there's an optional fuel-injection engine with horsepowers up to 283, and a softer ride. For more, see p. 113.

3-MINUTE WALK-AROUND



1. Five inches longer
2. Slightly lower
3. A mite narrower
4. New body panels
5. Bigger windshield
6. 14-inch wheels
7. Lower hood
8. Air vents in headlight shrouds



Those soaring tail fins plus broader, lower body give the 1957 Plymouth a patrician look.

Plymouth: Brand-New Body

BESIDES its elegant restyling, this car is outfitted for 1957 with a bigger engine and new camshaft, bigger brakes, new heating-ventilating system, and torsion-bar springing in front. For more details on the new Plymouth, turn to p. 113.

3-MINUTE WALK-AROUND



1. As low as 54.8 inches
2. Three and a half inches wider
3. Dished steering-wheel hub
4. 14-inch wheels
5. Bigger windshield
6. No-guard bumpers
7. Side-by-side lights
8. Step-down floor



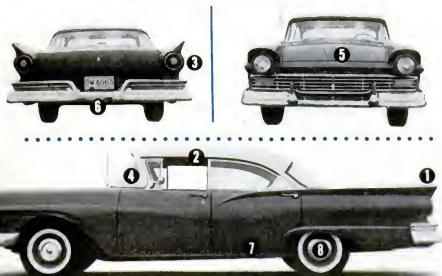


Just to stress a point: The new Ford hardtop's roof is only 56 inches above the ground.

Ford: Newly Tailored

ALONG with a wholly redesigned chassis—longer, lower, wider—the '57 Ford offers four engines with top horsepower of 245, a new ventilation system and a more cushiony ride. Cornering, too, is improved. Read more about it on p. 113.

3-MINUTE WALK-AROUND



1. Seven inches longer
2. Up to four inches lower
3. One inch wider
4. More windshield wraparound
5. Front-hinged hood
6. Guardless rear bumper
7. Step-down floor in the rear
8. 14-inch wheels



The 1957 Dodge manages to look longer without stretching an inch—it's just built lower.

Dodge: One Big Engine

INSTEAD of offering the usual choice in eight-cylinder engines, Dodge limits you to one big one in 1957—with 325-cu. in. displacement, 8.5:1 compression ratio. The six-cylinder model has 8:1 compression. For more, see p. 120.

3-MINUTE WALK-AROUND



1. Bigger glass area
2. Three inches lower
3. Step-down floor
4. 14-inch wheels
5. New color combinations
6. Side-by-side lights
7. Bigger rear-fender fins
8. More windshield wraparound





Hudson

A 255-hp. V-8 engine, with overhead valves, 327-cu.-in. displacement and 9:1 compression ratio distinguishes the '57 Hornet.



Nash

With the same engine as Hudson's Hornet, the '57 Ambassador has a new, lower chassis, four-eyed headlights, more maneuverability.

Rambler

For 1957, this pert little car can be had with a 125-hp., six-cyl. engine or a 190-hp., eight-cyl. engine, burning non-premium fuel.





Studebaker

The supercharged Golden Hawk is still the showpiece. Regular-line lures: a 275-hp. engine, nonslip differential, faster steering.



DeSoto

In the Chrysler family, only DeSoto is longer—an inch. Engine size is up to 340 cu. in. And there's a new series—the FireSweep.



Lincoln's addition to the family is two inches lower, an inch wider, than two-door brother.

Lincoln: 4-Door Hardtop

ADDING a snooty new hardtop to its 1957 brood, Lincoln has given them all more pep. Compression has been boosted from 9:1 to 9.9:1, lifting horsepower up to 300. There is thermostatic air-conditioning, too, and better spark advance.

3-MINUTE WALK-AROUND



1. Four-eyed headlights
2. More rear glass wraparound
3. One inch wider
4. Two inches longer
5. Two-level front bumper
6. Canted fins
7. Concealed twin tailpipes
8. Electric door locks





Mercury's more powerful 1957 line has allotted more space for heads, long legs—and hips.

Mercury: Air Cushioned

WHEN you're through admiring Mercury's smart new looks, consider these added assets: air-cushioned rear-spring anchorage, push-button automatic transmission, speed-compensated shock absorbers, 290-hp. engine. Then see p. 124.

3-MINUTE WALK-AROUND



1. Five inches longer
2. Three inches wider
3. Three inches lower
4. More windshield wraparound
5. Front-hinged hood
6. Step-down floor
7. Novel rear-light styling
8. Guardless bumpers



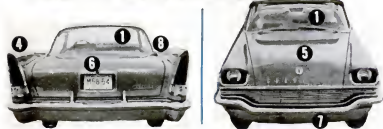


Chrysler driver's horizon is broadened with bigger windshield. There's a fancy dash, too.

Chrysler: Power Surge

A zooming rise in piston displacement (392 cu. in.) of the New Yorker, shown here, is Chrysler's biggest 1957 news. There's a new series, too—the Saratoga, matching the Windsor in its displacement (354 cu. in.). Read more on p. 120.

3-MINUTE WALK-AROUND



1. More glass area
2. Lower belt line
3. Roof three inches lower
4. Bigger fins
5. Lower hood
6. Lower rear deck
7. Guardless front bumper
8. Windows slant inward more

How they compare:

Chevy, Ford, Plymouth

By Devon Francis

WHEN Chevrolet, Ford and Plymouth went on display in their 1957 dress last month, they gave a lot of people a jolt.

The "small, simple" cars had outgrown their pants. They were bigger than ever, more powerful than ever, more luxurious than ever. The prices: higher than ever, by about \$65.

Where Chevrolet, Ford and Plymouth leave off, and Cadillac, Lincoln and Chrysler New Yorker begin, is now a blurred boundary.

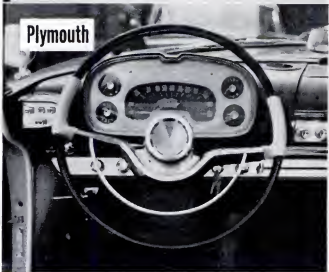
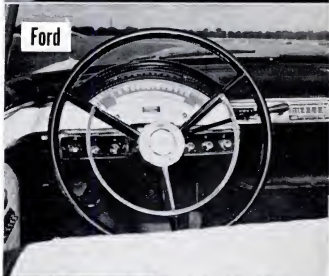
Here are just *some* of the tasty tidbits that manufacturers have incorporated to separate customers from their money:

- Optional fuel injection.
- Sports-car lowness.
- Interiors swiped from a maharajah's throne room.
- A softer ride but flatter cornering.
- Scattier getaway.
- Windshields that wrap around clear back to here.
- Torsion-bar front suspension.
- Step-down floors.
- A thump-free transmission.
- And—of course—more horsepower.

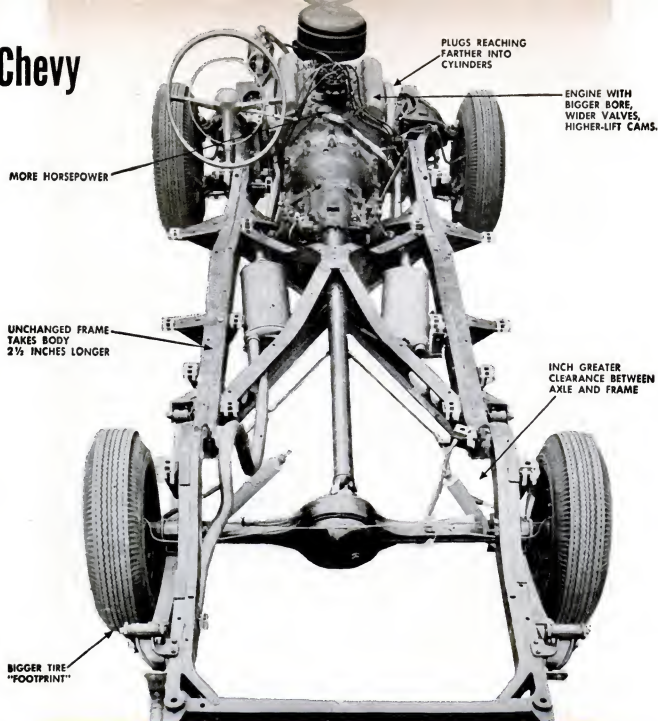
What this means doesn't take a Solomon to figure out: To sell their wares in 1957, the manufacturers are resorting to everything but Bank Night.

The new Chevrolet, Ford and Plymouth offer the same thing—extraordinarily good transportation—but what they have in common could be held in your hat. In an industry noted for its aping, that's news.

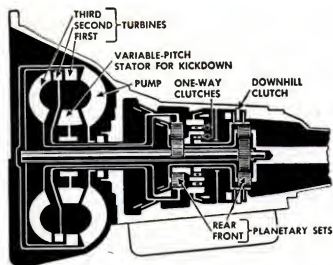
All three cars now have ball-joint suspension in front. All have the new



Chevy



Chevy's chassis carries engines with options of fuel injection or two four-barrel carburetors.



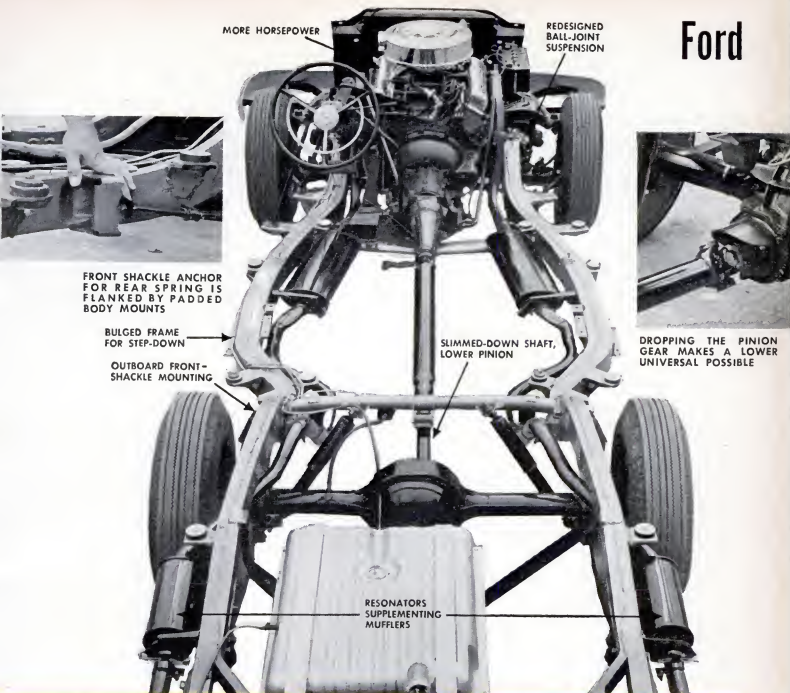
CHEVY'S NEW TRANSMISSION has jerkless kick-down for acceleration, and geared Hill Retarder.

14-inch wheels. All have that sublime ability to go through a hard turn without a skittering of the rear end. All have fishtails. All have better ventilation systems. All have horsepower that no driver can use to the limit without getting tagged. And model for model, all are priced about the same.

Beyond this, the three automobiles differ rather widely. Take a look at them, in alphabetical order:

CHEVROLET

Chevy offers two king-size mechanical changes, both optional, in an "off-year" model that normally would pass



Ford chassis is notable for Mae West curves, lowered side rails, wider treads front and rear.

with skimpy modifications. One is a constant-flow type of fuel injection (see page 127) that does away completely with a carburetor. The other is a Buick-like, thump-free automatic transmission. Both bespeak a shrewd maneuver by Chevrolet to take some of the bloom from spanking-new cars by Ford and Plymouth.

Chevy's introduction of fuel injection was probably the best-kept secret of the new model year. As forecast by *POPULAR SCIENCE* last February, the new fuel system solves many of the nagging problems of conventional carburetion.

The constant-flow system has had its drawbacks. The most pressing, perhaps,

was the engineers' inability to obtain a satisfactory flow of fuel at idling speeds. Chevrolet figures it has that whipped.

The company's second big development is that new transmission, called Turboglide. Take heed, here, because Chevy's method of handing off torque from the engine to the rear wheels is a new plateau in transmission engineering.

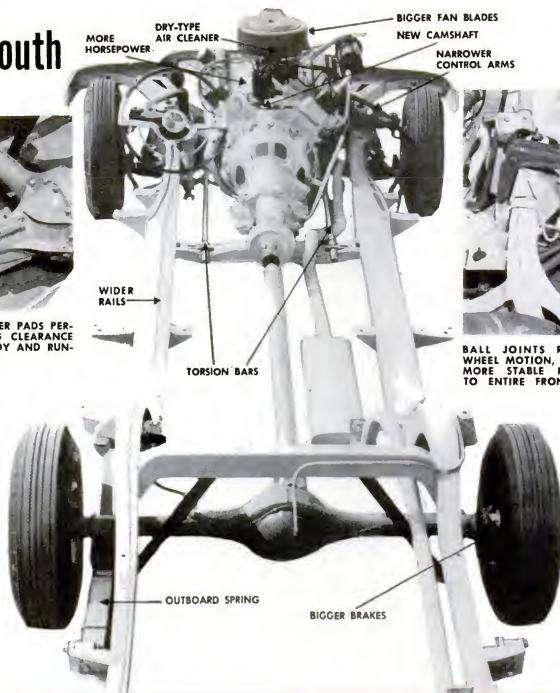
Chevrolet's older Powerglide—still being offered—has a two-turbine torque converter, with a single planetary gear system as a tailpiece to help in push-multiplication.

When the planetary is rolled in and out of the power train, a band and a

Plymouth



SOFTER BUMPER PADS PERMIT SHAVING CLEARANCE BETWEEN BODY AND RUNNING GEAR



MORE HORSEPOWER

DRY-TYPE AIR CLEANER

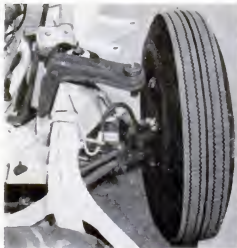
BIGGER FAN BLADES

NEW CAMSHAFT

NARROWER CONTROL ARMS

WIDER RAILS

TORSION BARS



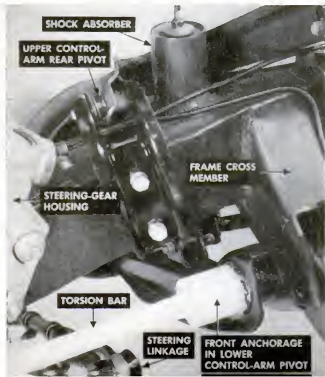
BALL JOINTS REDUCE WHEEL MOTION, GIVE A MORE STABLE FEELING TO ENTIRE FRONT END

OUTBOARD SPRING

BIGGER BRAKES

Plymouth chassis features rear springs with a stiffened segment to prevent "axle windup."

TORSION-BAR SPRINGING and ball-joint front suspension reduce steering wheel fight.



SHOCK ABSORBER

UPPER CONTROL-ARM REAR PIVOT

FRAME CROSS MEMBER

STEERING-GEAR HOUSING

TORSION BAR

STEERING LINKAGE

FRONT ANCHORAGE IN LOWER CONTROL-ARM PIVOT

multiple-disk clutch evoke a slight thump, common to Chevrolet and also to Ford's and Plymouth's automatic drives.

The new Turboglide still has a torque converter with a tailpiece. The box carries *two* planetaries, in tandem. But there are no hands to seize the drums, and in the converter, backing up the conventional pump that whizzes the oil around, there are *three* turbines.

The first turbine goes into action when the engine revs up the pump from a standing start. It boosts the torque to the drive shaft. *And* it's connected solidly to the rear planetary for greater torque.

As the car comes unstuck, oil from the



LOWEST OF THREE for '57, Plymouth sliced off inches with smaller wheels, mounting rear spring

shackles outboard, reducing clearance between body and running gear, thinning down roof.

pump begins surging against the buckets of the second turbine. This is connected directly to the front planetary to boost its torque.

As the car gains speed, the first and second turbines begin free-wheeling, the planetaries roll out of the torque-multiplication scheme, and the *third* turbine begins getting the bulk of the oil from the pump. It, too, is solidly linked to the planetaries, but at a one-to-one ratio. Thump is eliminated.

Chevy offers *eight* different horsepower ratings in engines with displacements up to 283 cubic inches and compression ratios as high as 9.5:1.

FORD

There is a feeling behind the saffron-hued front of the Ford Division headquarters in the Detroit suburb of Livonia that 1957 has to be Ford's year.

Ford claimed that it beat Chevy in sales in 1955. Chevy said it didn't, and then heaped insult on injury by peddling a lot more cars in 1956.

But Ford allows as how that this time around it can snatch the brass ring.

The Ford is down in height to as little as 56 inches, as described in the last issue of POPULAR SCIENCE. It's an inch wider. In the Custom series it's three inches longer. In the Fairlane it's more than nine inches longer.

Frames are heavier and stronger. Walk into any Ford showroom and ask

for a wheelbase, and the salesman will inquire politely, as though he were cutting bologna, "What length would you like?" They do have two sizes—116 and 118 inches. The variation in overall length is greater: on the posh Fairlane, they add five inches.

Then, the engineers have reworked the power plants. The holes for the pistons are unchanged, but the compression ratios are up. So are the horsepowers. The ratings range from 144 for the inline six, at 223 cubic inches, to 245 for the whopping 312-cubic-inch V-8.

The automatic transmission oil is now cooled by radiator water through a heat-exchanger, rather than air-cooled. This isn't brand-new. It was a running change during the 1956 model year.

Ford now has 19 models of cars in five lines, including its station-wagon line. If you don't like the Custom jobs, you can get the Custom 300, or the Fairlane, and if you don't like any of those flavors, you can get the Fairlane 500. The main difference is in the shimmering facets, and what you are out of pocket to get them. The wagons—five different ones—constitute a fifth category.

PLYMOUTH

Some 18 months ago a chap named John P. Mansfield, the grand vizier of Chrysler's Plymouth division, called his top executives into his office and said grimly, "Okay, let's get back in business."

The following figures apply to a four-door sedan, in each company's top line of cars, carrying a volume-production engine and an automatic transmission. All measurements are in inches except where otherwise specified.

| | HORSEPOWER | PISTON DISPLACEMENT (cubic inches) | BORE AND STROKE | COMPRESSION RATIO (:1) | HP. PER CUBIC INCH | CAR WEIGHT PER HP. (pounds) | MAXIMUM TORQUE (lb.-ft.) at r.p.m. | OVERALL MAXIMUM TORQUE MULTIPLICATION OF TRANSMISSION (:1) | FUEL REQUIREMENT | Manual STEERING RATIO (:1) | Power |
|-----------|------------------|---------------------------------------|-----------------|------------------------|--------------------|--------------------------------|---------------------------------------|--|------------------|----------------------------------|-------|
| CHEVROLET | 245 ^a | 283 | 3.87 x 3 | 9.5 | .86 | 13.9 | 300 @ 3800 | 4.3 | Prem. | 25.7 | 23.3 |
| FORD | 245 ^b | 312 | 3.8 x 3.44 | 9.7 | .78 | 14.2 | 332 @ 3200 | 5.04 | Prem. | 27 | 27 |
| PLYMOUTH | 235 ^c | 301 | 3.91 x 3.13 | 8.5 | .78 | 16.1 | N.A. | 4.47 | Reg. | 26.8 | 19.8 |

^a Without fuel injection; seven other engine options offered

TODAY'S "SMALL" CARS make "big" cars of yesteryear seem almost anemic. Only five years

^b Three other engine options offered

ago Cadillac had a whopping 190 horsepower, Chrysler's New Yorker 180 and Lincoln 160.

He had reason. Buick had elbowed Plymouth out of third place in sales in 1954. It has clung there since.

It took a long time to build a wholly new Plymouth, but there is hardly anything that can be said about the changes in the 1957 vehicle that would be an extravagance.

You think the Ford has a low roof? Pshaw! The Plymouth goes clear down as far as 54.2 inches on the hardtop. It looks even lower. That's because it's 3½ inches wider. Yet, unlike the Chevrolet and the Ford, it's no longer. In fact, it's a sliver of an inch shorter, despite an increase of three inches in wheelbase. The addition in wheelbase was invested mostly in reducing the front overhang.

That's only a pittance of the changes in appearance.

The windshield is higher, and wraps around more. The roof projects to make a visor for the windshield. The bumpers

are devoid of guards and—seriously—are described as "split-level." The tail fins should supply a final conclusion to this trend in styling. The headlights effectively simulate the new duals by being bracketed with the parking lights.

The Plymouth frame, like Ford's, is rugged, although it doesn't bulge. To accommodate a step-down floor pan, so the driver and his passengers have adequate headroom, the frame rails—straight—were squashed and widened. The body is mounted on them, not inside them. Plymouth says this is necessary for strength and torsional rigidity. The whole frame is 50 pounds heavier.

More headroom had to be scrounged somewhere, and here the stylists of yesteryear, who once imperiously demanded Plymouth's high, proud benches, will squirm. The seat heights, are down as much as 3.2 inches.

On the mechanical side, Plymouth



STRIKING DIVE CORRECTION in the new Plymouth on sudden braking is shown graphically in this

photo. Nearer car is a '56. Solution lay in relocating the upper-control-arm inner pivot.

| | TURNING-CIRCLE DIAMETER curb to curb (feet) | BRAKELINING AREA (square inches) | GROUND CLEARANCE | WHEELBASE | OVERALL LENGTH | WIDTH | HEIGHT | OVERHANG | | HEAD ROOM | | SHOULDER ROOM | | HIP ROOM | | LEG ROOM | |
|--|--|-------------------------------------|------------------|-----------|----------------|-------|--------|----------|------|-----------|------|---------------|------|----------|------|----------|------|
| | | | | | | | | Front | Rear | Front | Rear | Front | Rear | Front | Rear | Front | Rear |
| | 44.5 | 158 | 6.2 | 115 | 200 | 73.8 | 59 | 32.5 | 52.5 | 36 | 35.6 | 56.9 | 56.4 | 62.1 | 63 | 44.7 | 39.8 |
| | 41.6 | 180.1 | 7.1 | 118 | 207.7 | 77 | 56 | 35 | 54.7 | 38.9 | 38 | 57.3 | 57 | 60.1 | 60.1 | 45.1 | 42.5 |
| | 42.5 | 184 | 7.3 | 118 | 204.6 | 78.2 | 57.3 | 32.2 | 54.4 | 35.9 | 34.6 | 60.5 | 60.4 | 63 | 62.7 | 45.9 | 42 |

^c Other engine options, some dealer-installed, offered

N.A.—Not available

Chevrolet's top engine for 1957 develops 253 hp. Pounds of weight per horsepower are more

than halved since 1952—Chevrolet's was 31.4 pounds, Ford's 29.2 and Plymouth's 30.7.

junked everything except its engines and transmissions and started from scratch.

The front suspension is on ball joints. The pivots of the upper and lower control arms are embedded in rubber. The rear-spring anchorages are outboard of the frame. The rear axle is bigger.

But the biggest news in Plymouth, perhaps, counting everything, is torsion-bar suspension in front. Unlike Packard's, which incorporates an automatic load-leveler, Plymouth's slim bars, replacing the conventional coil springs, are simple. A pair of hex nuts lets you balance the car laterally or stiffen the springing for added load.

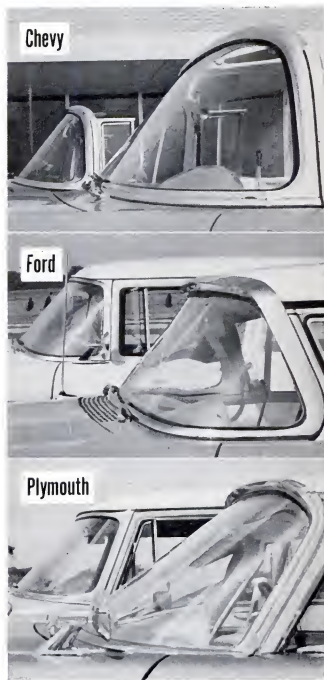
The change in Plymouth's ride is going to win purple prose. It's light, but firm. No longer can the sports-car cult complain that this car won't take corners. In weeks of testing on rough northern Michigan roads last spring, it shot through square turns head-high. The low silhouette helps. So do the torsion bars and the shackling of the rear springs. So do struts that stabilize the front end.

All this, at long last, mends that irritating habit that the Plymouth has had of haunching down in a hard takeoff and of diving in a panic stop. END

..... NEXT MONTH:

For news and pictures of more 1957 cars, see Popular Science for December.

Buick • Oldsmobile • Pontiac • Cadillac
.....



WINDSHIELDS ARE CHANGED. New versions are in foregrounds. Chevrolet's is an inch deeper. Ford's sweeps back more, is down in depth from 16½ to 15 inches. Plymouth's is up 5½ to 22.

What's new in the

Chrysler Family for 1957



Imperial's lower roof and belt lines make it look rakishly long though inches shorter



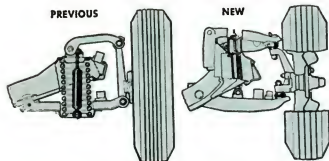
Chrysler headlines more displacement, a new transmission, and a third series in the line

A low, low look cloaks bigger power plants, new torsion bars and a husky, uniform frame.

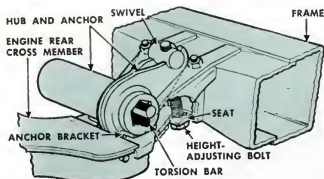
By William C. Callahan

FOR the third year in a row, Dodge, DeSoto, Chrysler and Imperial are out with a packet of new concepts in engineering and design.

The entire line is also fresh and pleasing to look at. Previewing the cars for POPULAR SCIENCE in Detroit several weeks before they appeared in the show-

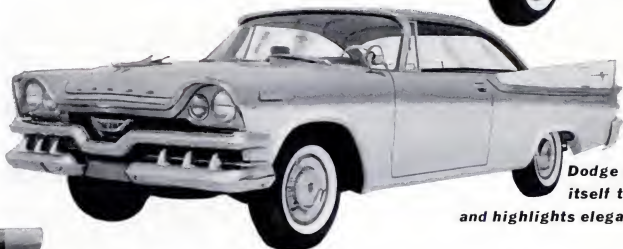


CONTRASTING SKETCHES show how ball-joint spindle mounts (right) improve front suspension.



REAR-MOUNTING BRACKETS for torsion bars provide for adjusting car height if the springs sag.

**DeSoto's two larger series
have expanded in
length as well
as performance**



**Dodge restricts
itself to one big V-8
and highlights elegance of styling**

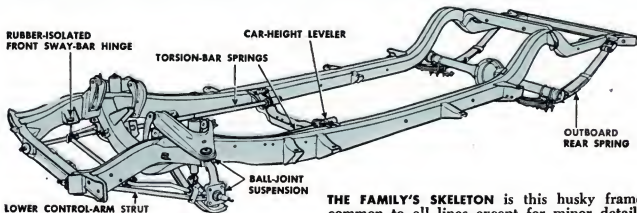
rooms, I was impressed at the start by the increase in glass area front and rear.

Imperial in particular has something that could start a trend—a windshield that is a “wrap-over” as well as a wrap-around. My second strong impression was that of lowness: Belt lines on all cars have been lowered $1\frac{1}{2}$ to two inches and roof lines have been dropped three inches or more. With the exception of DeSoto (which is one inch longer), Chrysler-built cars have stopped outgrowing their garages. Some Chryslers are two inches shorter and Imperials 5 $\frac{1}{2}$ inches shorter, which is certainly a step

in the right direction. All lines appear longer, however, because of the sleek roof lines.

There are a raft of mechanical innovations for 1957. Major changes include new frames; torsion-bar springing in front and ball-joint spindle mounts; and engines with increased displacement, horsepower and torque. As with many other 1957 cars, there are new 14-inch wheels and new paper air filters on the carburetors.

The family chassis. One interesting experiment Chrysler is trying this year is that of using a uniform chassis layout on



THE FAMILY'S SKELETON is this husky frame, common to all lines except for minor details.

NOVEMBER 1956 121



BETTER OVERHEAD VISION and a spicily futuristic look are the joint benefits of a windshield that, besides sweeping around to the sides, climbs up over the front of the car onto the roof.



A SHARPLY TAPERED REAR DECK poses fresh problems for the guy who has to load the trunk but enhances the car's dashing appearance. The rear-glass area has been much increased.



REDESIGNED INSTRUMENT PANEL keeps the transmission's push-button controls at the far left. You'll now press Neutral to spin the engine, thus avoiding the chance of starting in gear.



THERE'S MORE FLARE to the tail fins, which, in combination with bolder treatment of the rear-light assembly, add a pert final touch to a dramatic array of body styling changes.

all its cars. With the exception of minor differences in dimensions and thickness of steel, chassis are identical for Plymouth, Dodge, DeSoto, Chrysler, and Imperial. They are husky hunks of metal, with box-section side members, a step-down design, and five cross members.

The new torsion bars, which contribute to the lower car silhouettes, work on the same principle as those used in Indianapolis race cars. The round bars, anchored on the rear engine-mount cross member, extend forward parallel to the frame. Their front ends are tied to each lower control arm.

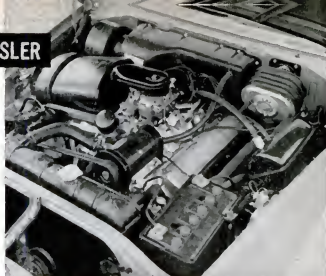
When a front wheel hits a bump, the up-and-down movement of the control arms is resisted by twisting of the bar itself. A manual adjustment in the rear mounting bracket lets you increase the car height if the springs sag after long service. But this is a garage operation, *not* a self-leveling device such as Packard uses.

Less sway and dip. Another change in the front end is Chrysler's version of ball-joint spindle mounts, which eliminate the kingpin. Steering effort is materially reduced. The upper control-arm pivots are located on the frame so that,

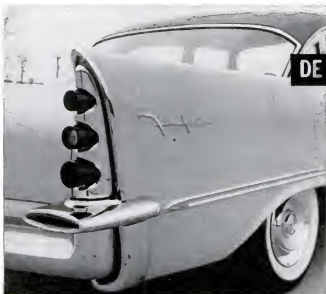


CHRYSLER

FOR A BROADER VIEW of the road at night, twin headlamps, in this provocative setting, are installed in cars to be delivered in states where the lighting innovation is now legal.

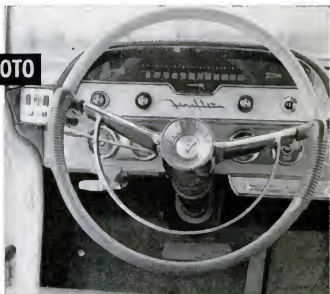


A RICH INHERITANCE from the Imperial is the 392-cu.-in. engine tucked away under the New Yorker's broad hood. Its high-dome pistons have raised the compression ratio to 9.25:1.



DE SOTO

AN IMPRESSIVE LINE-UP of lights (from top to bottom: stop-and-turn, back-up and regular tail-lights) is displayed at the ends of the new DeSoto's increasingly upswept rear fenders.



A DISHED STEERING WHEEL is a welcome refinement for the restyled dash. Like all other members of the Chrysler family, DeSoto in 1957 will also sport flush-type handles on the doors.

during braking, part of the forward weight shift is counteracted. This reduces front-end dipping by as much as 65 percent on sudden stops.

The semi-elliptic rear springs are mounted with the axle forward of the middle point, and the shorter spring leaves are also centered here. Reason: beefing up the forward segment of the springs reduced the tendency of the spring to "wind up" under the twist of hard acceleration. This also permits a shallower drive tunnel and further lowering of the car's silhouette. The rear springs are mounted outboard, outside

the frame, which gives them a wide base to resist body roll on turns.

Two automatic transmissions are available: TorqueFlite, which has three forward gear ratios besides the converter; and PowerFlite, which provides two forward speed selections. Push-button control is continued this year, but an innovation is the use of the Neutral button to start the engine. The switch is turned on in the usual manner, and then the Neutral button is pressed.

Here are the highlights on each car: **Imperial.** Engine displacement has

[\[Continued on page 258\]](#)

**Like a crown prince, behind locked doors
and barred gates, the Big M is born—
pretty as a new penny and rarin' to go.**

The 1957 Mercury: Longer, Wider and... Lower



ANY relationship that the new Mercurys bear to those that have gone before is purely coincidental.

Horsepower? It's up. Performance? It's up. Length, wheelbase, interior room? They're up. Height? Well, maybe that's the only dimension that has gone down.

There is no mistaking the appearance of the '57 Merc. Any myopic five-year-old will be able to name the car with those identifying concave strips at the belt line. Visible a block away, astern they become two big, fat exclamation points as running lights. The only thing lacking is a pennant whipping the breeze.

The obvious is the least of the changes in the Merc. For the first time in its history the car has a body all its own. The Mercury's sheet metal panels no longer are to Ford's as Pontiac's are to Chevrolet's. But the Mercury's frame, like the Ford's, is bulged at the sides for a "step-down" floor.

The valving of the shock absorbers is "compensated"—it snubs down the springs for a soft ride at low speeds and "blows off" fluid to give the springs full travel at high speed.

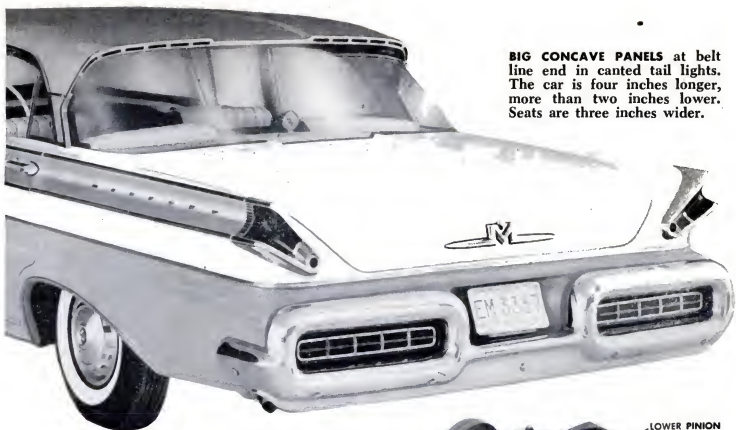
Brakes are bigger. Brake-drum surface on the Mercury model that carries the regular 312-cubic-inch-displacement



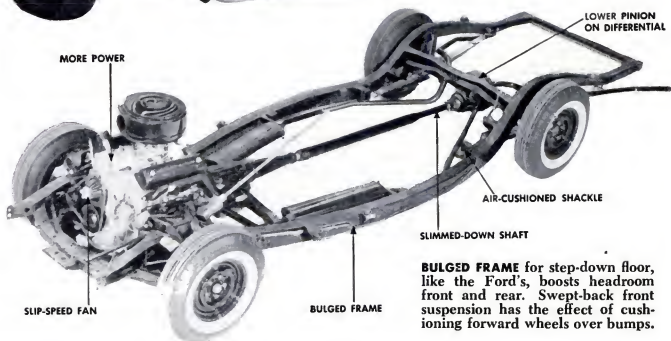
CONCEALED CENTER PILLAR on sedans gives them that hardtop look. Edges of the window frames cover the pillar when the doors are closed.

engine has been increased from 190 square inches to 212 on the 1957 cars. Mercs sporting the monstrous new 368-cubic-inch engine are supplied with 233 square inches of braking surface.

The smaller engine produces 255 horsepower at a compression ratio of 9.75:1, and the bigger one, no less than 290 horsepower at 9.75:1. The Mercury's most luscious power offering in 1956 was 235 horses. Also under the hood is an item borrowed from the sister Lincoln—a thermostatically operated air duct for the carburetor. If the engine is warm, air comes from outside the engine com-



BIG CONCAVE PANELS at belt line end in canted tail lights. The car is four inches longer, more than two inches lower. Seats are three inches wider.



partment. If it's cold, it comes from inside. Result: a fast, no-stall warmup in winter, more power on hot days.

A surprise awaits the man who slips into the driver's seat for the first time. Gear selection on the automatic transmission is by push button. Merc calls it Keyboard Control.

To start the engine, you turn the ignition key and *then* push a Neutral-Start button. That not only starts the engine but cancels out whatever was on the keyboard before.

A push button on the keyboard releases the foot-applied emergency brake.

A push-pull bar integral with the keyboard engages or releases the transmission brake. A sensing device prevents engagement of the reverse button above ten miles an hour. The remaining two buttons are just plain, old Drive and Low.

Two items to shush vibration and noise come with some of the new Mercurys. One is a new kind of front shackle for the rear springs. Those springs and the rear axle carry all the acceleration and braking reactions on cars with Hotchkiss—as opposed to torque tube—drives. Mercury engineers say that four-fifths of all the vibrations in the rear suspen-



CARBURETOR AIR automatically is either warmed by manifold or drawn fresh from outside, in accordance with engine needs. Thermostatic control does trick. Carburetor has dual bowls.



AIR-CUSHIONED SHACKLE looks like a cookie can. It "softens" attachment of the forward end of the rear spring to the frame, thus absorbs rear-spring vibration before it gets to the body.

sion are transmitted to the car through the front ends of the rear springs.

An *air cushion*, a sort of little rubber tire between the car frame and the front spring eye, is their answer. It's built into station wagons and all Monterey and Montclair models except convertibles equipped with the 368-cubic-inch engine.

The other item is an optional variable-speed fan with an oil clutch to reduce engine-compartment noise and boost power. When the car is scurrying along at a speed calling for an engine r.p.m. of

anything above 2,600, the clutch keeps the fan r.p.m. down to that figure or below. The rest of the cooling is done with ram air. At lower car speeds, the fan will turn at as little as 1,500 r.p.m. or less, if no cooling is required. Mercury says the system saves as much as 17 horsepower of the engine output.

All the changes in the Mercury point to one thing—this Ford division is grim on the point of providing back-talk to Buick, Oldsmobile and Pontiac in 1957.

At Mercury there's a chap named George Muller, executive engineer. Under the direction of Harold C. MacDonald, director of car engineering, Muller decided to pull a gamble.

The longer a car was a-borning, he knew, the easier it was for competitive companies to collect precious information about it. It usually required nine to 10 months, from the time a handmade prototype was delivered to the "cut-off date"—the point of no return, where the design was finally frozen in the dies, jigs and tools.

So the prototype 1957 Mercury was not turned over to production engineering until last spring. Muller promptly put two shifts of engineers to work. Before the first of summer's mosquitoes began drawing blood, he was ready for production—in half the time that's usually required.—*Devon Francis.*



CLOTH HARNESS for moppets, distributing pressure of the seat belt, when braking, over the entire chest and abdomen, is an option. An added advantage: a child can't unlatch it.

How it works:

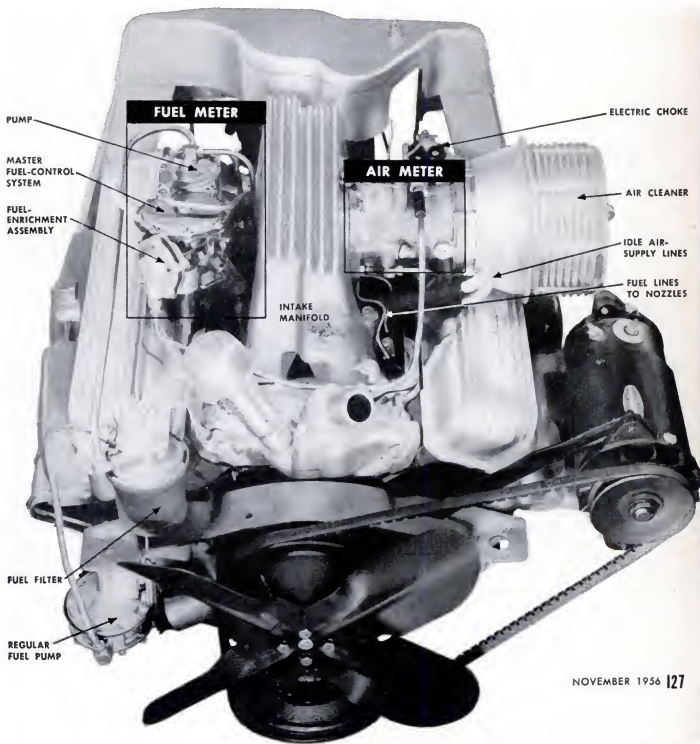
Chevrolet's New Fuel Injection

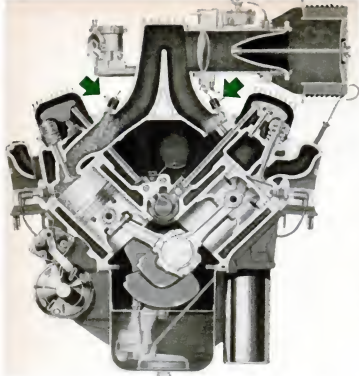
Nozzles and a "tent" replace carb in the first system of its kind for U. S. passenger cars.

A FUEL-INJECTION system in place of a carburetor—the first of its kind on U. S. passenger cars—was announced last month by Chevrolet as an option for 1957. Another first: Fitted to

one new Chevy engine, it produces one horsepower per cubic inch of displacement—283 horsepower from a 283-inch power plant.

Fueling is by constant-flow instead of by metered pulse flow as in the American Bosch system (PS, Feb. '56, p. 140). The fuel sprays from nozzles at each cylinder and is mixed with the air just ahead of





Fuel-injection control depends on engine vacuum

ROAD-LOAD CONDITION

Main vacuum-control line measures air flow to cylinders. By regulating position of a diaphragm which raises or lowers a plunger in fueling circuit, it determines flow of gas to atomizing nozzles (arrows in engine cutaway, left). Plunger is a two-way faucet, controlling, according to amount of intake air flow, both amount of fuel fed to cylinder and amount returned to reservoir as excess. Air picks up vaporized fuel as it passes .011-inch nozzles in front of intake valves. High-pressure fuel pump, driven by flexible cable off distributor, always supplies an excess of gas, creates pressure up to 200 pounds per square inch in the fuel lines.

.....

STARTING AND ACCELERATION

Enrichment vacuum-control line is added to provide richer mixture for starting cold engine and for acceleration. In starting, solenoid wired to starter switch throws lever depressing plunger. This reduces flow of excess fuel back to reservoir and increases flow to cylinders. Release of starter switch de-energizes solenoid. To keep mixture rich until engine warms up, electric choke is provided. Bimetal spring closes valve, shutting off vacuum in line to second diaphragm. This releases a spring which, by lever action, continues to depress plunger. As engine warms, electric heating coil causes bimetal spring to open vacuum line and lean out mixture. Lever on choke operates a fast-idle cam to hold throttle valve open and admit extra air. In accelerating, low vacuum in same line causes same diaphragm to richen mixture.

.....

COASTING AND IDLING

Over-run vacuum line is added, along with auxiliary air supply, for coasting and idling. When throttle is closed for coasting, a third diaphragm comes into play. At high vacuum, it pulls up a ball valve, a sort of cork in top of fuel reservoir, so pump submerged in it cannot build up any pressure to fuel lines. This cuts off all gas to cylinders. In idling condition, auxiliary air, piped from in front of throttle valve, is fed to each fuel nozzle. Otherwise, engine vacuum would tend to draw gas into cylinders without enough air to burn it, and engine would die. Air from this line enters nozzle itself, making it a tiny, temporary carburetor.

the intake valves. This version is considerably simpler than pulse flow. It has no reciprocating parts. There are, in fact, only four essentials—a pump to maintain fuel pressure, a valve supplying fuel in proper proportion to the air flow, a control system working off intake air vacuum, and the fuel atomizers for the cylinders.

A metal tent for incoming air sits on top of the engine as a substitute for a conventional intake manifold.

The air-fuel mixture is set for a road load (part throttle) condition, as near to the ideal of 15 parts of air to one part of fuel, by weight, as possible. Special devices take care of starting the engine when cold, enriching the mixture for acceleration, and idling and coasting.

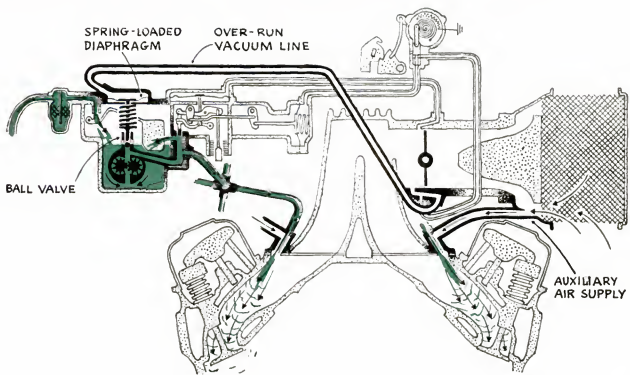
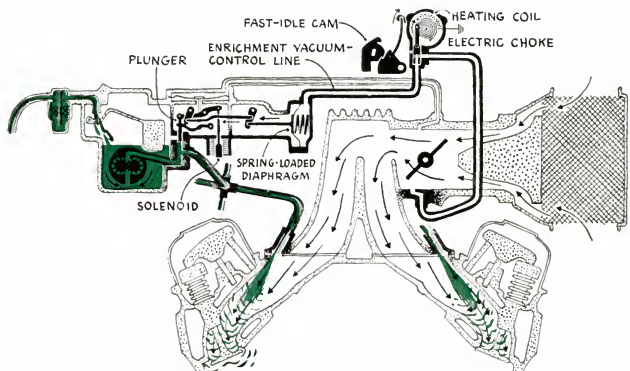
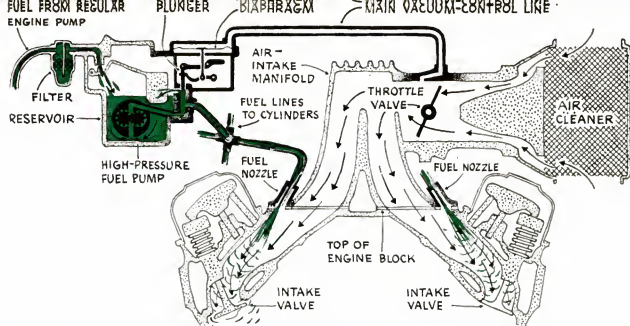
As in the pulse fuel-injection system, pressing the accelerator valves only air to the engine. The control system automatically meters gasoline flow to suit.

Chevrolet claims several advantages for its fuel injection as compared with conventional carburetion:

- It is not subject to vapor lock or icing.

- A cold engine starts smoothly.
- Each cylinder gets the same fuel-air diet—no engine stutter or buck.

- Fuel injection gives better fuel economy, with "noticeable" savings in gas above 30 m.p.h.—*Devon Francis.*





JET-AGE "GOOSE," with twice as much horsepower as its parent, will look like this when it comes off the line, in February.

The 'Tin Goose' Is Flying Back

By Joseph Dorlaque

PHOTOS BY W. W. MORRIS



STARTING A DAY'S WORK, a 28-year-old Ford transport lumbers past the tall monument (above) that is the weather yardstick by which Sky Tours pilots gauge visibility and ceiling when they begin their regular 16-mile round of Lake Erie island airports.



SUPERIOR VISIBILITY from the high-winged Tin Goose (left) was one reason why Admiral Byrd chose it in 1929 for his aerial exploration of the Antarctic. It also helps to explain why the venerable trimotor has made such an enviable safety record.



***Still earning their keep in back-country flying,
the corrugated old trimotors that Ford made famous
will soon be joined by a peppier, bigger version.***

THEY'RE going to resurrect the "Tin Goose"—the ancient Ford trimotor plane that first took to the air back about 1925, when Charles A. Lindbergh was just an unknown flying officer.

The Hayden Aircraft Corp., in Bellflower, Calif., plans to start production in February on a modernized version of that corrugated-aluminum wonder of the airways, sometimes called the "flying washboard."

The new trimotors will have improvements. But they are being designed from the original blueprints, stored in the Ford archives at Dearborn, Mich., for the past 23 years.

The trusty Tin Goose never wholly retired. Ford made 196 of them, and about 30 are still flying commercially. Its slowness and simplicity, quick lift

and ponderous payloads, plus its extraordinary safety record, make the Goose a popular plane for short-haul and low-altitude work in remote regions from Alaska to Southern Rhodesia.

To see how this indestructible old clunker has survived in the jet age, you

"YOU HAVE TO FLY THEM ALL THE TIME," a pilot of the trimotors commented as he pointed out the controls. "There aren't any trim tabs that you can set and then sit back and relax."





Trimotor lands and takes off in a third the space a DC-3 needs and on a crude Ohio field.

couldn't do better than to visit the busy, venerable airline serving the Sandusky Bay area of northern Ohio. This outfit, called Sky Tours, Inc., uses the flying tin lizzies on most of its regular runs. In 26 years of operation, the line says, it has never injured a passenger.

"For our purposes, it's the best airplane ever made," says Ralph Dietrick, head man at Sky Tours—the "world's shortest airline."

Sky Tours is an air-ferry and charter service that operates out of Sandusky and Port Clinton, Ohio, making short flights to five popular resort islands in Lake Erie between Cleveland and Toledo. Two of the Ford planes and an aged Boeing twin-engine job are its star performers.

A mile from the airport at Put In Bay, on South Bass Island, stands a 352-foot granite monument that serves as a weather-observation system.

"If we can see it, we've got visibility enough to operate," says Dietrick. "If we can see its top, we've got enough ceiling."

The pilots wear T-shirts and any old slacks, and riders hail them by their first names. Passengers move over to make room for freight. In past years the Fords have hauled chicks, crates of livestock feed, reels of barbed wire and even livestock, right along with their human cargo. Dogs, fish, game, groceries

and coffins are still routine shipments.

The air service started in 1930 with a mail contract. At first it used open-cockpit planes, like the Waco and Gates Day Standard. In 1935, as passenger and cargo business grew, it bought, secondhand, the two Fords still in daily service. The records are lost and nobody remembers how many hours these Fords had worked before 1935. But they've been putting in 500 to 600 hours a year ever since, Dietrick estimates.

Sky Tours sometimes finds 100 to 300 passengers waiting for a scheduled Ford flight that seats only 15, including the pilot. Then reserve pilots and planes are called out. The company carried a total of about 40,000 persons last year.

Other planes in the fleet are the 15-place Boeing 247D, and eight four- and five-place Cessnas. Only three of the line's 10 pilots are "checked out" in the Fords. Some of the others ride 'em as passengers for fun on days off.

It's hard work flying the Tin Goose, but one of the things that endears it to its owners is the way it performs on the rough, cow-pasture landing fields of the islands. Lumbering and clacking mightily over the bumps with its gross load of five tons, it takes off or lands at 55 miles an hour in 500 to 600 feet. Its top speed is a vibrant 110.

"There's a smooth place on down the field here somewhere," Dietrick said with

a grin the other day as he bounced one of his planes in on a lumpy field of grass on Pelee Island. He tugged the hand brake and played the throttles to head her toward the frame terminal building. "They use this part for baseball, too," he remarked a minute later. "We're crossing short right field."

Mud and slush don't bother the Tin Goose. It'll take off or land in two feet of snow, Dietrick says. Last winter, when major airlines were canceling flights to Ohio's major cities, Sky Tours' Fords went right on island-hopping, chugging along under the overcast at 85 to 90, their sedate cruising speed.

"Many's the time, though, on the ground in a stiff wind," said Dietrick, "that we've cussed that hand brake—when we needed all the fingers and toes we could find to hold her tail down, to handle three throttles, keep her headed right and brake the wheels, all at the same time. It takes some fancy rassling to get the job done."

Loading the Tin Goose is easy (but watch your head!), and it doesn't need much fixing.

"Oh, sometimes we have to scrounge around for parts or even make a part, but it isn't hard to keep 'em flying," said a Sky Tours mechanic. "No reason why they shouldn't be good for another 25 years."

The Fords have worn out many a 235-hp. engine ferrying people and packing the mail and groceries. They make stops like milkmen—20 or more daily.

Tourists, hunters and fishermen by the thousand visit the wooded island playgrounds that the trimotors serve, summer and winter. About 818 people live there all the time. The air service is their only year-round contact with the mainland. They depend on it to bring fuel, milk and newspapers, to take the kids to school, and for fast help in emergencies. You can phone for a plane any time.

The islanders think no more about riding the Fords than you do of boarding a bus. One day the nose engine twisted off one of the planes and splashed into

[Continued on page 278]



IT'S AN AERIAL BUS for most passengers, but the aged transport plays heroic roles, too. Many's the time, in early-morning hours, that it has rushed islanders to mainland hospitals.



MAINTENANCE is made easier by such primitive Tin Goose features as fixed props and landing gear. Sky Tours, Inc., changes each of these 235-hp. Wright Whirlwind engines once a year.

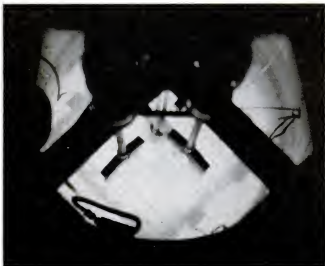


PILOTS HELP LOAD and unload mail and a wide range of freight, handle baggage and collect fares—\$1.50 to \$4 for scheduled one-way trips—in addition to riding herd on the planes.

How Safe Are Our A-Power Plants?

Experts bare the weird hazards of nuclear-electric stations, and tell of the measures being taken to protect you.

By Alden P. Armagnac



BLAZING WITH BLUE LIGHT, four-foot-diameter experimental reactor hits power peak exceeding 500,000 kilowatts without going out of control, in newest AEC program of safety trials.

WILL an atomic power plant make a desirable neighbor—or will it endanger you and your property? With seven full-scale nuclear powerhouses building or projected, people in many a community will soon be asking that question.

In some of the frankest official statements to date, the Atomic Energy Commission and its advisers now reveal the inside facts about A-power hazards.

We're entering an era, they say, of high-powered nuclear reactors. Unlike earlier atomic plants, "quarantined" in remote unpopulated places, these powerful new reactors will be relatively near cities to supply them with electricity.

Without proper precautions for the public's safety, here might be the makings of an appalling accident. That's why designers are bending over backward to surround the new A-power stations with more-than-ample safeguards—like the huge and picturesque steel globes, domes, and tanks that seal off power reactors from the outside world.

RECENT hearings on the problems of insuring atomic-electric plants gave the man in the street a hair-raising introduction to their potential hazards. A single major A-power disaster conceivably could result in casualties and property loss totaling a staggering \$500,000-000 in damages, Congress was told.



SPECTACULAR TEST succeeds in tricking Borax I reactor into running away. As spring-ejected control rod flies out, reactor emits flash of nuclear light, and gray smoke issues from top.

Dr. C. Rogers McCullough, chairman of the AEC's Advisory Committee on Reactor Safeguards, minces no words in explaining why. An A-power plant can be roughly compared, he says, to a factory making virulent poisons and explosives under the same roof.

Weight for weight, he estimates, the fission products formed in every nuclear reactor are 1,000,000 to 1,000,000,000 times as toxic as any other poison known to industry. These radioactive "ashes" accumulate in reactors' fuel elements. The amount produced daily is almost in direct proportion to a reactor's power.

The longer it runs, the more it stores. A high-powered reactor may hold hundreds of pounds of fission products, equivalent to hundreds of tons of radium.

Their escape into the open air would imperil people for miles around. Externally their gamma rays are deadly. And some are extra-dangerous if breathed or swallowed, in dust or spray. Bone-seeking radio-strontium and thyroid-seeking radio-iodine concentrate in those organs and attack them with radiation at point-blank range. So the prime concern of A-power safeguards is to prevent an accident from loosing the dangerous fission products.

Most to be guarded against is a reactor "runaway," the fierce eruption of heat energy from an out-of-control reactor.

Now, a runaway reactor can't possibly



RUNAWAY-PROOF REACTOR would be major advance in safety. Seeking one, researchers test promising Borax I design. By ejecting a geyser of water, as above, it stops a runaway reaction.

blow up like an atom bomb. There may be a mild explosion, forceful enough to send pieces flying. Fire, or violent chemical reactions, are possible complications. Or a reactor's innards may just turn to a molten blob. In any case, the fission products are the real peril.

FIRST line of defense against their escape is the metal shielding of the uranium fuel elements. It will be breached if a reactor runaway melts or vaporizes the elements, releasing the fission prod-



A SPLIT-SECOND LATER, high-speed movies catch growing smoke cloud, which rises to height of 80 feet. Hurling up through it are fragments of burning uranium-aluminum fuel plates.



LARGE PIECE OF DEBRIS sails through air at height of explosion. But a runaway reactor can't blow up like an atom bomb, and this blast compares to that of only a few pounds of TNT.



SAFE DISPOSAL of waste sodium, in water-filled quarry, shows explosive reaction of this reactor-cooling agent with water—and warns of the hazard of using water to fight a sodium fire.



RUNAWAY CANADIAN REACTOR, in background, made history's worst radioactive mess by loosing a million gallons of contaminated water. Cleaning it up took these masked workers a year.

ucts in the form of a radioactive cloud.

Runaways are possible because present-day reactors are so ticklish to control. No other machine is capable of such sudden and extreme bursts of energy. Withdraw the control rods only a shade too far, and the nuclear fire blazes out beyond control with frightening speed. Once a runaway starts, no human being can react fast enough to stop it.

SO REACTORS have quick-acting safety mechanisms, to take control out of an operator's hands in an emergency and slam the control rods home. And if the safety devices should fail? That's when the operator sounds the evacuation alarm.

Far from being melodramatic fancy, this has actually happened. Canada's 10,000-thermal-kilowatt reactor at Chalk River ran away, in 1952. Fuel rods and their aluminum jackets melted down. Fission products poured out. The reactor's cooling-water stream caught most of them, but the water itself gushed from the ruptured jackets and cascaded into the basement of the building. Before the flood could be stemmed, the basement held a 1,000,000-gallon pool, containing

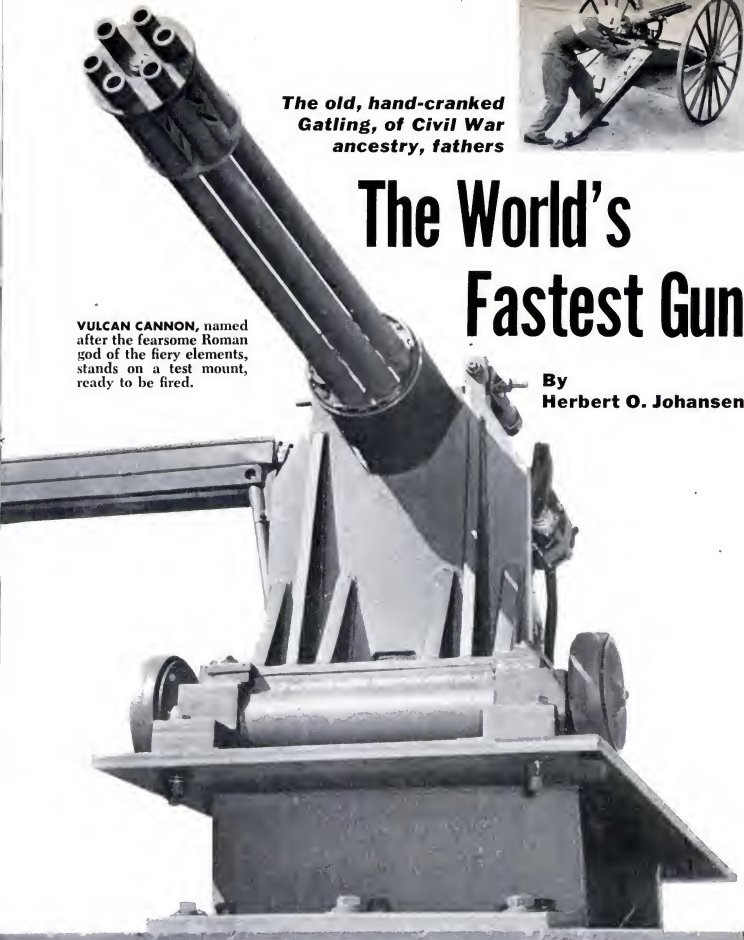
fission products equivalent to 22 pounds of radium. Pumping out the deadly fluid to a distant burial ground, through an improvised pipeline, was the beginning of a herculean clean-up task that took a year. The runaway was officially ascribed to "a mechanical failure" in the control-rod system.

Our own 1,400-thermal-kilowatt Experimental Breeder Reactor in Idaho ran away late last year. To end a sharp power rise, a scientist told the operator to shut down the reactor "instantly," which meant pressing a fast-shutoff button. The operator misunderstood. He applied a slower-acting drive that inserted the control rods two seconds too late.

IN that brief time the reactor's power, doubling every 0.27 of a second, rose 170 times and overshot the safety point. There was no noise, explosion or fire—the reactor simply quit working, sure sign of a "meltdown." The building was immediately evacuated as a precaution. It turned out that only an insignificant amount of radioactivity escaped, though the reactor core was a fused wreck.

Fortunately no one was hurt in either

[Continued on page 248]



**The old, hand-cranked
Gatling, of Civil War
ancestry, fathers**



VULCAN CANNON, named after the fearsome Roman god of the fiery elements, stands on a test mount, ready to be fired.

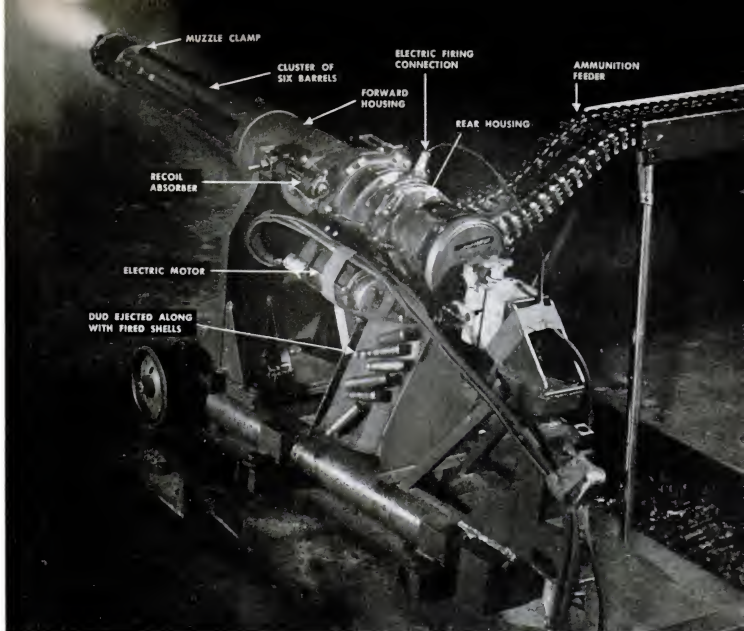
The World's Fastest Gun

**By
Herbert O. Johansen**

PHOTOS BY W. W. MORRIS

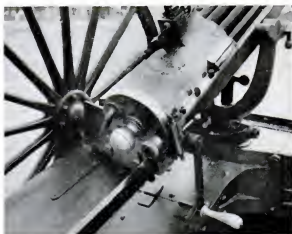
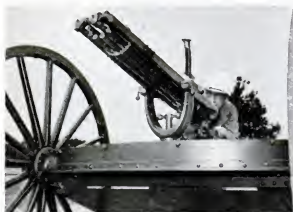
OUR newest supersonic jet fighters will be armed with a machine gun that was invented during the Civil War and was abandoned by our military around 1911 because *it fired too fast*.

Then it was not practical to haul enough ammunition for prolonged fire against slow-moving or stationary battlefield targets. Today, with jet speeds presenting split-second air-battle targets,



Strobe flash at 1/1,000 second shows seven shells ejected as gun fires several more rounds.

Gatling: the machine gun that was too fast 94 years ago



In 1862 Dr. Richard J. Gatling received a patent that was to revolutionize firepower, and warfare, in the 19th century and into the 20th. A 1903

model of the multi-barrel, hand-cranked Gatling Gun, made by Colt's Patent Fire Arms Co., is shown above. It fired .30-caliber ball ammunition.

you have to throw lots of lead fast to make a kill.

The new Vulcan 20-millimeter aircraft cannon—which throws more than a ton of metal and explosive a minute—does just that, in much the same way as the famed, almost century-old Gatling gun. It has six rotating barrels in a cluster. It is not automatic. Instead of using the energy of its own discharge to operate the firing mechanism, as in most machine guns, it has an outside power source. In the original Gatling that power was the right arm of a soldier turning a crank. In the Vulcan it is electricity or hydraulic fluid. The electric version has a GE motor which, although only about the size of a car generator or a quart juice can, develops 25 horsepower.

Ordinance experts at the Aberdeen Proving Ground in Maryland told me that the Vulcan is the world's fastest firing machine gun, but they would not reveal the exact rate of fire. I decided to be smart and find out for myself as the gun was firing. A 60-round burst was coming up. A warning whistle sounded. I fixed my eyes on the sweep-second hand of my wrist watch. A second whistle. Fire! A deafening noise and a blinding flash. I blinked. Before I could look at my watch again, it was all over.

How long did it take to fire 60 rounds? I timed it another way as the next 60 rounds were firing.

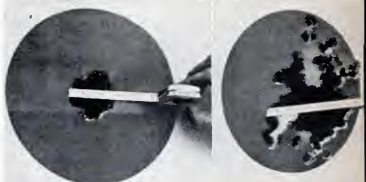
"Brrrp," I mouthed. That was it. Definitely split-second. There had been no individual, staccato "ra-ta-ta's" of each round as with other machine guns. The roar was continuous—like the sound of stout canvas being ripped, amplified a thousand times.

The actual rate of fire of the Vulcan is secret. But since the main objective in its design was speed, one may safely surmise that it is faster than an electrically driven Navy Gatling that spewed at a rate of 5,000 rounds a minute in 1895.

Eye-witness estimates vary from a low 4,000 to an incredible 18,000 rounds a minute. I would put it somewhere in between. The rate of fire can be varied, and it has been announced that the Vul-



BULL'S-EYE TARGETS are mounted on screens of an Aberdeen Proving Ground machine-gun test range. Electric eyes will record the bullet velocity and rate of fire as the Vulcan shoots.



DISPERSION PATTERNS of a 60-round burst are measured. At left above is shown target nearest the gun, at right farthest one away. Study of the patterns helps evaluate gun performance.



FAST-MOVING ROLL of wrapping paper behind the last target shows individual bullet holes. Shapes of the holes indicate whether the projectiles were traveling straight or yawing.



REMOVING THE MUZZLE CLAMP is the first step in field-stripping the Vulcan 20-mm. aircraft cannon. The gun can be completely field-stripped and reassembled in less than 30 minutes.



REAR-LOCKING MECHANISM of individual barrels is released by removing a single pin, as in the picture above. Wear on the six barrels is heavy at the gun's terrific firing speeds.



BARRELS PULL OUT easily. Other steps in field-stripping the Vulcan include removal of the six firing bolts in the gun's rear housing and taking out the ammunition feeder assembly.

can be slowed down to stutter at a lazy rate of 3,000 rounds a minute.

World War II airplane machine guns fired at a rate of less than 1,000 rounds a minute.

Vulcan is termed the ultimate in aircraft machine guns. One gun designer says that it would be impossible to make a mechanism that would fire faster. But there will be no need for such a weapon. In 10 years there probably won't be a machine gun in the air. It will be all rockets and guided missiles.

Why revive the Gatling? The principle of the rotating multi-barrel cluster is the answer. No single-barrel gun could possibly stand up under the terrific rate of fire needed in modern aerial combat. And even if a single barrel could take that heating and beating, you wouldn't be able to get the shells out fast enough; the bullets would be tagging each other.

Army Ordnance and the General Electric Co. took on the job of building a gun that would catch up with increasing jet speeds. As far back as 1946 they began a detailed study of all types of machine guns patented in the U.S. There were thousands of them.

The Gatling emerged as the best and only bet.

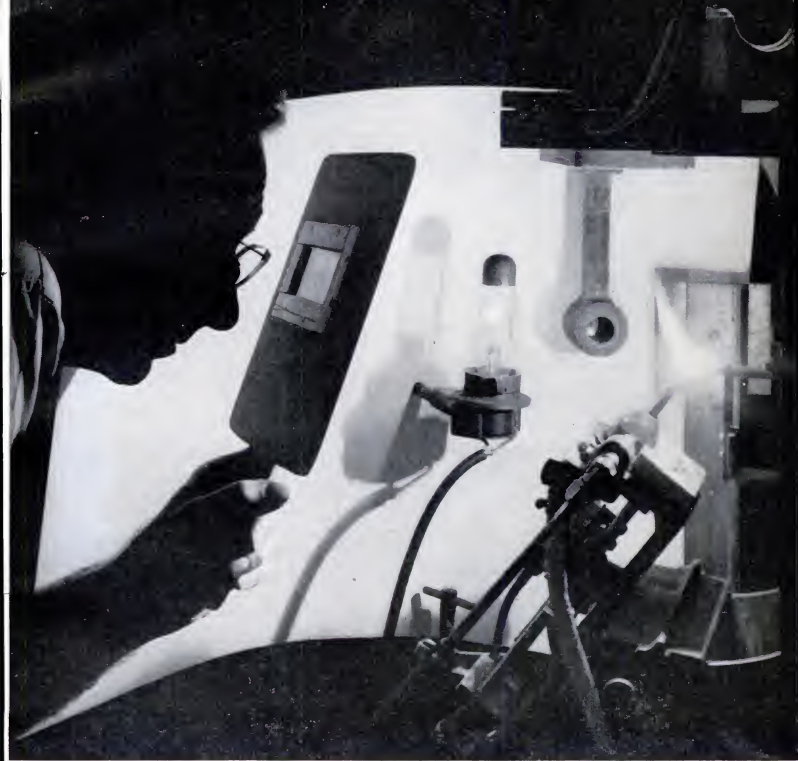
When the Vulcan is triggered electrically, this is what happens. The rotating mechanism spins the six barrels at one end and their six firing bolts at the rear. As each bolt passes the feeder it picks up a shell and shoves it forward into the breech block. A contact closes an electric circuit that ignites the primer, firing the round. The bolt then extracts the empty cartridge case and ejects it on the other side of the gun. This operational cycle of the cannon—firing at the 12-o'clock position, ejecting an empty cartridge at the seven-o'clock position, picking up another shell at the five-o'clock position—is accomplished virtually simultaneously.

The Ordnance people look at the Vulcan as a "machine that fires" rather than a gun. Remove the barrels and the firing bolts, they say, and you have a machine

[Continued on page 260]

Picture News

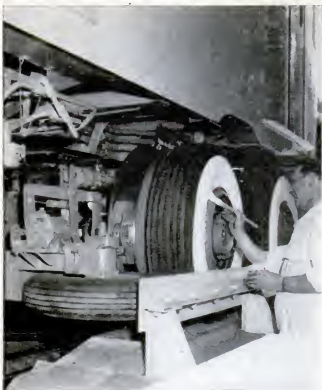
IN THE WORLD OF SCIENCE



New Arc Light Is So Bright It Casts Shadow of 200-Watt Lamp

THE arc at right above, produced by two carbon electrodes, is one of the brightest lights ever developed by man. Here it is shown casting a shadow of a lighted 200-watt filament lamp used in movie projectors. What causes its extreme brilliance is still a theory, but

National Carbon Company researchers say that its intensity and heat are roughly equivalent to those at the surface of the sun. The project is being conducted for the movie industry where brighter and truer light is sought for wide-screen, outdoor-theater and color projection.



Subway Runs on Rubber Tires

BRIGHT-PAINTED pneumatic tires are now making the Paris "Metro" almost silent. Replacing the old steel wheels, they are kept on the track by a horizontal wheel, also rubber-tired, mounted on each truck. This wheel runs against a track right-angled to the rails and prevents sway.



Naturalist-Photographer Takes

THROUGH a long tube with a giant lens mounted in its tip, Robert Crandall (above) made highly magnified movies of a quaint Mojave Desert honeycask ant

Seaplane Tanker Refuels Four Jet Fighters in Air at Same Time

IN ITS first multiple over-water refueling test, the Convair R3Y-2 below replenished the tanks of four Grumman F9F-8 jets in one five-minute operation.

Wing tanks of the four-engine turboprop Tradewind carry enough fuel for eight of the fighters. It feeds them with four drogues housed in pods under the wings.

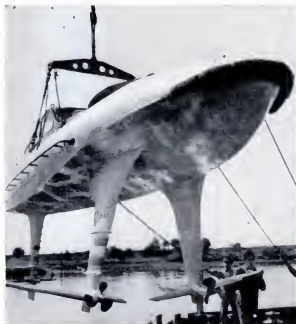




a Long Shot of an Odd Desert Ant Loaded Down with Honey

for Walt Disney's new film, "Secrets of Life." Mrs. Crandall helped to guide the movie equipment. The ant, its abdomen swollen with honey, is staggering home-

ward, where, suspended from the ceiling of its underground chamber, it will become a living cask for hungry brother members of the ant colony to feed upon.



German Boat Rides High and Fast on Three Giant Winged Legs

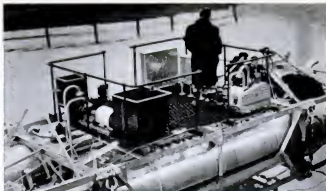
THIS ominous-looking vessel, being launched by derrick at left, did better than 30 m.p.h. on the Elbe River with its builder, Friedrich Wendel, at the wheel. Wings at the foot of its three legs skim higher and higher in the water the faster

the boat goes, with the legs riding halfway out at full throttle. The rear leg is movable for steering the craft; propellers on the two front ones drive it. The front wings also have movable fins to neutralize rolling in rough seas.



Solar Battery Soars High

THE high-altitude balloon above is taking a solar battery aloft. It is part of a research project conducted by General Mills' Mechanical Division to sound out the possibility of tapping the sun as a power source for future earth satellites.



Waterworks Cruises to Site

THIS floating waterworks will travel the rivers of Iraq, dropping anchor to purify and pump 3,000 gallons of water an hour to cities en route. The British-built plant knocks down for overland transport.



Telephone Talk Without Hands

THE shopper shown here with both hands hanging onto packages is making a telephone call from an experimental booth under test in Chicago. A recessed microphone and amplifier let her speak and hear without holding a receiver.



X-Ray Probes the Insides of a Spinning Engine to Spot Flaws

THE 15-million-volt betatron being swung into position at left takes X-ray pictures of the inside of a running engine. The apparatus peers through steel,

stopping visual high-speed motion in strobodiagraphs like the one at right. The equipment was worked out jointly by General Electric and the Detroit Arsenal.

New Outboard Motors Feature Power Boosts, Fuel Savings

UPPED to 35-hp., Evinrude's quieted, electric-starting 1957 Lark, top of a nine-motor line, has a slip-clutch propeller with weed cutter. Its Cruis-Throttle cuts fuel consumption as much as 20 percent.

RATED at 60 hp., the new Mark 75 Mercury outboard has a vertical six-cylinder engine with a displacement of 59.4 cubic inches. It comes with electric starting and a built-in generator.

A JET fuel system that is said to save up to 34 percent on gas is one of the features of the 1957 line of Scott-Atwater outboards. Most luxurious of nine motors offered is the 40-hp. Royal Scott below.





Army Captures a Jug of Air from the Borderline of Space

EIGHT quarts of 75-mile-high air are in this steel bottle—one of six sent up in nose cones of two Aerobee rockets. It will tell Signal Corps scientists what

earth satellites (see p. 156) and future spaceships must go through. At peak rocket flight, the bottles snapped open and shut to trap the precious catch.

These Fast New Navy Jet Trainers Perform Like Combat Planes

BUILT like operational jet fighters, the new Temco TT-1 (left) and North American T2J (right) are expected to turn out jet jockeys fast. They'll travel

at 350 and 460 m.p.h. respectively, and have controls similar to those of their combat brothers. Big clear canopies give instructor and student wide vision.





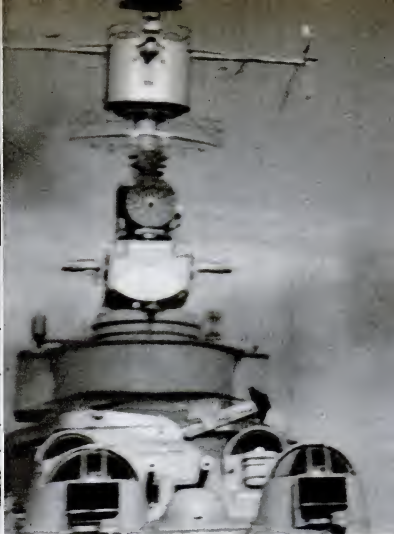
Talk-and-See Phones Come Closer to Reality with New Designs

THESE two experimental setups make vision-phones almost commercially feasible, engineers of the Bell Telephone Labs say. Either one requires only one extra phone line. The pictures don't flick constantly like TV—they change only every two seconds. The unit at top has

the camera lens above the picture receiver in the same box; in the model below, camera and receiver are separate units. Using either, you would have to flick a switch before the other party could see you. The final version is expected to be much smaller.



Navy's New Anti-Sub Rocket Permits Long-Range Attack on Undersea Prowlers



WEAPON ABLE, new Navy anti-submarine rocket being loaded at left in a special launcher aboard the destroyer leader USS *Wilkinson*, heads for its target in



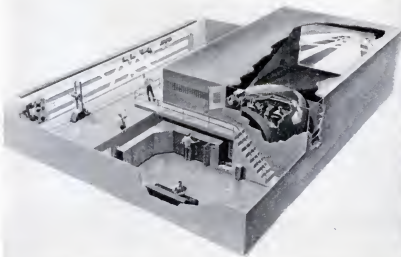
Cable Hitch Carries "Casualties" Across Stream in Army Training

"RIDING the rope" over a stream, Medical Corps trainees at Brooke Army Medical Center, Tex., learn the latest tricks in getting wounded soldiers from

the battlefield. The cable hitch can be flung in jig time across narrow waterways, and the men are then winched or hand-drawn from dry land to dry land.

training exercises above. The rapid-fire missile has a variable range, weighs 500 pounds and carries a charge about equal to a conventional depth charge. The

launcher swings around so the crew can fire on sight, and from afar, without the ship having to maneuver for position in the vicinity of the submarine.



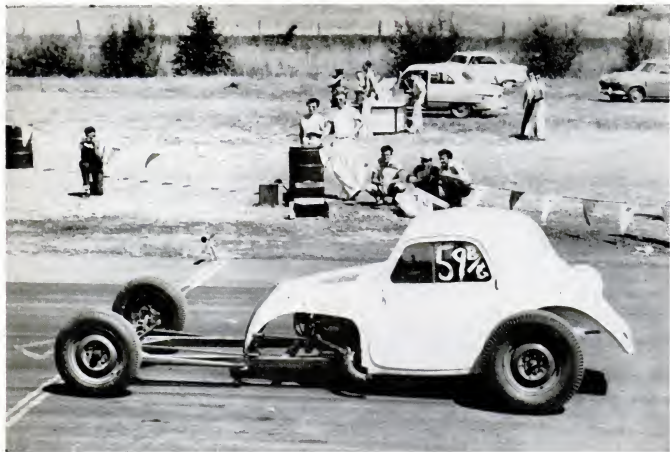
Televised "Airport" Will Help Break In Jet-Airliner Pilots

WHEN the Douglas DC-8 makes its first passenger flight late in 1959 or 1960, pilots already will have made hundreds of visual "landings" and "takeoffs" in the 560-m.p.h. jet airliner.

Their flying will have been done in a novel Link ground trainer that uses television to give the pilot a changing landscape as he would see it from the jet.

The system, called Telerama, projects a panoramic view of a three-dimensional scale model of an airport on a 15-foot screen in front of the flight simulator's cockpit, as in the cutaway at left.

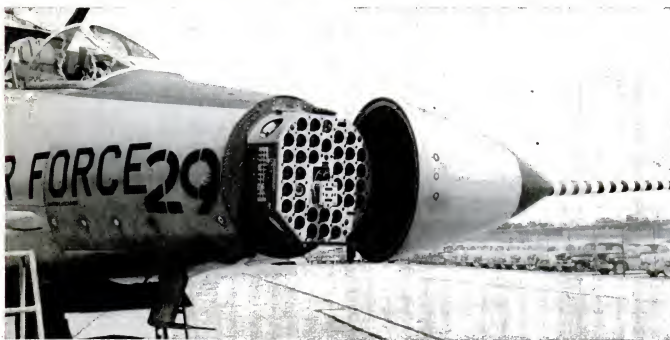
The TV camera, moving along a track, is able to reflect a pilot's flight maneuvers in relation to the airport. What he sees is shown in the photo above.



Long Wheelbase Runs Front End Right Out From Under Hood

HERE is a front end that is really out front. Drag-race enthusiasts in Los Angeles gave their old Fiat coupe this odd broken-down appearance by welding

an extension to the front of the chassis. Object of the stretched-out hot rod is to put more weight on the rear axle, improve traction and make a fast getaway.



Camera in Jet's Hinged Nose Takes Movie of Test Instruments

How does a busy test pilot keep a record of multiple-instrument readings during a flight? McDonnell Aircraft Corp. makes it easy with this F-101A at Edwards AFB Flight Test Center in California. The Voodoo's complex test in-

strumentation is mounted in its hinged nose, and a movie camera centered in the panel is aimed at a mirror in the hinged section. The filmed reflection is then screened for study at post-flight conferences of the pilot and test engineers.



Trussless Roof Over Big Arena Is Put Up with Nuts and Bolts

Six- to 10-foot lengths of corrugated steel form the roof over the 120-by-260-foot arena of the new Phoenix (Ariz.) Coliseum shown above. Workmen using only nuts and bolts to fasten the curved sheets end to end (lower right) and side

to side erected the roof in 7½ days. Absence of trusses will provide a clear view from each of 5,000 permanent seats. The makers, Wonder Building Corp. of America, Chicago, say the 18-gauge steel can stand a 113-mile wind or 5½-foot snow.



Weather Dome Wards Off Windburn and Keeps Cyclist Dry

TIRED of the windblown look, this German student partially enclosed his motorbike and now arrives at classes with every hair in place. A metal hood

topping the shatterproof windshield keeps his head dry on rainy days. The rear of the weather dome is open—but who drives backwards?

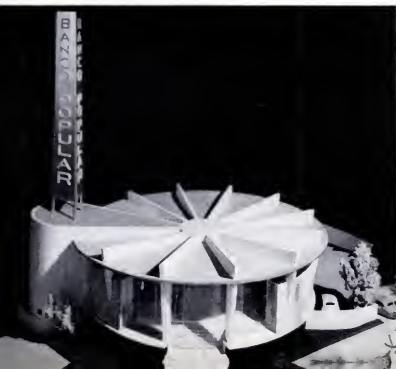




Deep-Well Probe Checks Soil at Atomic Dumping Grounds

WHAT happens when hot waste is buried hundreds of feet deep in atomic dumps? To find out, GE men at the Hanford (Wash.) plant use a new "eye"—a

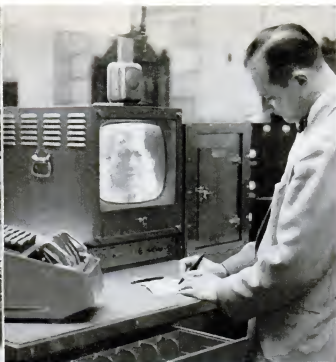
crystal of sodium iodide sealed in aluminum (left). Lowered by cable into test wells, it transmits spectrum analyses of the soil to the trailer at right.



These Modern Banks Are Designed to Fit the Weather

THIS circular bank, planned for Puerto Rico, is designed to stand hurricanes and earthquakes. Architect Chauncey W. Riley says the floor-to-ceiling windows won't be boarded up before storms; they will simply be replaced, if broken. The interior will withstand wind and water. Papers will be in a waterproof basement.

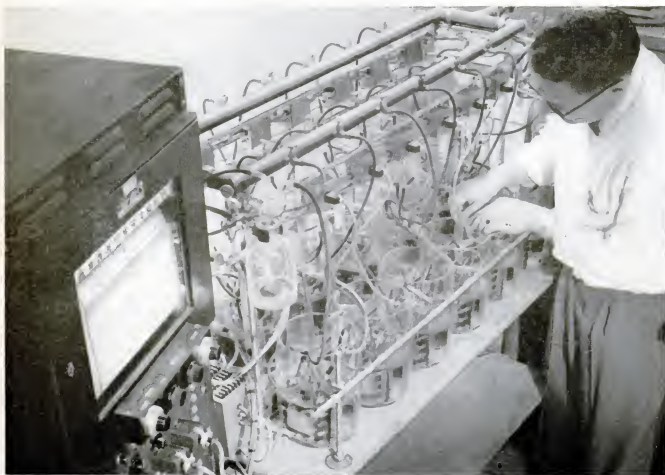
In contrast, the Federal Reserve bank (far left) at Houston, Tex., will have no windows at all. The two-million-dollar air-conditioned structure is designed to allow for a future five-floor addition.



TV Banking Lets Teller Handle Customer in Auto at Curb

DRIVE-IN customers of a Bridgeport, Conn., bank are handled by a teller deep inside the building. When a driver rings, a pair of TV screens and two-way speak-

ers are turned on and a delivery slot (left) is opened. Passbook, cash and papers whizz to and from the teller's cage (right) through a pneumatic tube.



Fuel Cell That May Power Subs Turns Gas into Electricity

THE complicated setup above is a new kind of battery. Oxygen and hydrogen set up positive and negative poles as they flow through tubes into a beaker holding

carbon plates immersed in fluids. Researchers at National Carbon hope to develop the fuel cells for reserve power supplies and for submarine propulsion.



Rolling X-Ray Puts a Penetrating Eye on Troop Transports

THIS mobile X-ray rig gives Douglas troop carriers a tough going over before delivery. The X-ray tube head rides a boom on a hydraulically operated tele-

scoping mast. Technicians shoot 178 photos to probe for structural defects or foreign material in areas that can't be reached by visual inspection.



Falcon Guided Missiles Nestle in Scorpion's Wing-Tip Pods

TWIN killer pods make the Northrop F-89H the Air Force's most heavily armed operational fighter. Three guided missiles are carried within each pod. For air firing (PS, June '56, p. 96) they

are extended from the sides, as shown above. The nose of each pod also carries 21 air-to-air rockets in clusters of seven. Any one of the missiles or rockets can knock down the biggest bomber.



Satellite to Have Shiny Shell, Gold-Plated Tracking Transmitter

LIGHT, rugged magnesium, shined to a mirror finish to reduce friction, will house scientific instruments in the man-made moons to be launched during the 1957-58 International Geophysical Year.

Among the instruments will be a tracking radio transmitter (inset) in an aluminum container gold-plated to make it a better heat shield. Moons will be the size of the sphere above, weight 22 pounds.

Science throws new light on a fascinating question: Can there be

Life Without Father?

Olie, first higher animal known definitely to have been born naturally without a father and to have survived more than a few hours, looks thoughtful at having made biologic history.



It can surely happen to turkeys, researchers reveal, but doctors are skeptical regarding Monica Jones.

By Herbert Yahraes



MRS. Emmimarie Jones is a good-looking brunette who lives in England and has an 11-year-old daughter named Monica.

Dr. Marlow W. Olsen is a big, graying embryologist with the Agricultural Research Center at Beltsville, Md. Each has been telling quite a story. Mrs. Jones, as you may have read in

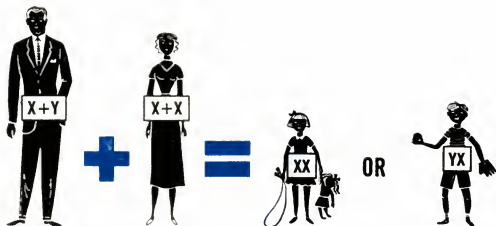
the papers, claims that Monica never had a father—that, in other words, she is a living example of the phenomenon known scientifically as parthenogenesis. That unwieldy word means reproduction of one's kind without the normal sexual preliminaries. Laymen call it virgin birth.

Dr. Olsen declares that some of the turkeys hatched at the federal research station never had a father, either. They came from eggs laid by virgin females.

Reproduction without benefit of males

How the sex of humans is determined

LIFE WITH FATHER



Males have two kinds of sex chromosomes, X and Y. Females have only one kind, X. When

male X and female X chromosomes unite, a girl is born. When male Y and female X unite, a boy

How the sex of turkeys is determined

LIFE WITH TOM



Male turkeys have two sex chromosomes of one kind—both X. Females have one sex chromosome, which means half their eggs contain a sex

chromosome (X), half don't (-). When male and female X chromosomes unite, a tom is born. When an X sperm and (-) egg unite, it's a hen.

is common among such lower forms of life as bees and aphids. Also it has been induced artificially in frogs, sea urchins, silk worms and even rabbits—in some cases by pricking the eggs, in others by treating them with acid, sea water, heat or cold.

While doctors are skeptical that parthenogenesis really took place in the strange case of Monica Jones, Dr. Olsen's investigations prove for the first time that it does occur naturally in a creature as high up the scale of life as a turkey.

FOUR years ago, Olsen and a fellow worker segregated 30 hen turkeys for a study, not of parthenogenesis but of fertility. Olsen had a hunch that a drop in the fertility of the Beltsville flock, amounting to about 50 percent between January and July, might somehow be related to a loss of feathers by the males. The idea was to mate some of the toms, when they started moulting, with the segregated hens. A close record would

then be kept of fertile and infertile eggs.

"But first," said Olsen to his teammate, S. J. Marsden, one of the developers of the Beltsville Small White turkey, "let's make sure the eggs now being laid are infertile." So they incubated eggs laid by the nonmated hens and then, one by one, Olsen broke them open and looked for evidence of embryonic development.

"Infertile," Olsen called out, and Marsden wrote it down. "Infertile . . . Infertile . . . Infertile . . ." It was just what they had expected.

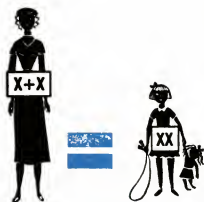
But then came an egg that was different. As the scientist broke it and sieved the contents through his fingers, he discovered a bit of membrane.

"Put this one down as fertile," he called out.

"It can't be," Marsden called back. But out of a batch of several dozen of the selected eggs, several others showed the same kind of growth.

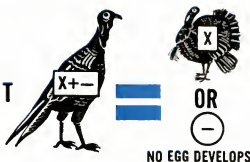
"It is certainly embryonic develop-

LIFE WITHOUT FATHER



is born. Theoretically, virgin birth, involving only female chromosomes, would produce a girl.

LIFE WITHOUT TOM



Virgin birth among turkeys is bound to produce toms (X chromosomes only), for super-female eggs without sex chromosomes never develop.

ment," said Olsen. "The question is: where is it coming from?"

He began to look for the answer.

TO SOME people, this is a humorous subject—life without a father. They snicker. They say the toms must have gotten in somehow. Or some joker must have switched eggs in the incubator.

Dr. Olsen foresaw this, so he kept the experimental birds under lock and key and cared for them himself. He put a lock on the incubator. He marked each egg with the date it was laid and the number of the hen that laid it. He even added a secret symbol, in invisible ink, which showed up only in ultraviolet light.

As a scientist, he gave himself harder problems. For example, was it possible that a hen known never to have mated could have received sperm some other way? Also, could it be that among a flock of supposedly virgin hens, one was a hermaphrodite?

To rule out all such possibilities, Olsen

separated hens and toms when they were only six weeks old, a time when turkeys have not begun to mature sexually. The hens he kept in individual cages. Yet, just like the other unmated hens under experiment, when they grew up they laid some eggs that developed at least a little way toward turkeys.

JUMP now to Saturday, March 10, 1956. At 10:30 in the morning, Dr. Olsen gently cracked the shell of a turkey egg lying on a table in the Beltsville hatchery and picked off bits of it with a pair of tweezers until a bird's head appeared. Afterwards, off and on for eight hours, he picked away other bits.

That night he kept the bird in the hatchery and the next day took him home in a portable brooder, which he plugged in next to his bed. Thereafter, every four hours, 'round the clock, Dr. Olsen fed his tiny charge. He got out of bed at midnight and at four to poke a mixture of crumbled egg and cottage cheese down the bird's throat. During the day he made special trips from his office.

This was unusual care for a turkey, but the turkey was unusual, too—the first fatherless poult to hatch and keep on living. The Beltsville staff named him Olie.

Dr. Olsen's score card for 1956 reads as follows:

One hundred and twenty-eight virgin turkey hens laid about 6,000 eggs.

Of these, about 1,800 showed parthenogenetic development, and of these 247 developed into embryos.

Seven of these fatherless turkeys came out of the shell alive, but five died during the first 24 hours. The others were Olie and a bird, born in April, named Popeye.

What causes parthenogenesis? Could it be that the egg cells are damaged?

"No," reports Olsen. "They are not interfered with in any way."

He knows that heredity plays a big part, because he has been selecting for breeding stock those birds in which the parthenogenetic trait is strongest, and

the proportion of "fertile" eggs from virgin hens went from 15 to 30 percent.

"Next year," he forecasts, "there will be embryos all over the place."

THE hens now being used in the investigation are the descendants of a remarkable tom known as Chris. Born in 1953, Chris was originally on the records as a female but, very late for a turkey, began developing big feet and other male characteristics.

He let out his first gobble at the age of 32 weeks—20 weeks past schedule.

Olsen suspects that Chris himself never had a father. That's because Olie, Popeye and the rest of them were also very slow in developing. Not a sign of life appears until the fifth day of incubation, four days later than usual, and the birds aren't ready to hatch until the thirtieth day, which is three or four days beyond normal time.

If Chris actually came from an unfertilized egg, that would explain his retarded development and the mistaken identification. In any event, this laggard gobbler now is as big and vigorous as other three-year-old toms, and his offspring carry more of the parthenogenetic trait than other birds Olsen has studied.

Environment also seems to have a part, though a small one. Anyway, some of the unmated hens are raised where they can see toms; others aren't. The first group—probably as the result of hormonal stimulation—lays a higher proportion of "fertile" eggs.

Of what practical value is all this? May we some day be able to eliminate sex in the turkey business?

Not a chance. The sex chromosomes in turkeys are such that an unfertilized egg can develop into nothing but a male. In other words, all parthenogenetic turkeys have to be toms—and hens will always be needed to lay the eggs from which they hatch.

The opposite would be true in human beings. There the egg, if it developed parthenogenetically, could give rise only to a female, according to genetic theory.

THE Thompsons were delighted with their new clock thermostat, which automatically kept house temperature at 72° during the day and 65° overnight. One Monday Thompson left on a business trip. "Daylight saving time ended yesterday," he told his wife. "But I've reset the clock in the thermostat, so the house will be cozy before you get up."

Two days later he had an urgent phone call. "It turned cold after you left," said his wife. "The house has been chilly ever since. I haven't touched the thermostat, but there isn't enough heat and I'm sure something is wrong."

...How Come?

ANSWER: Thompson had set the clock back one hour the same way he had all the other clocks—by turning it forward 11 hours as recommended. But this put the 65° setting on the day side of the dial, and the 72° setting on the night side. The remedy was to turn the clock an additional 12 hours forward.

BUT Olsen's work does throw new light on an old problem in the turkey industry, which each year incubates 100 million eggs—worth 30 cents apiece—and has to discard 40 million because they do not hatch. The Beltsville research suggests that many of these eggs, even if they contain an embryo, may never have been fertilized.

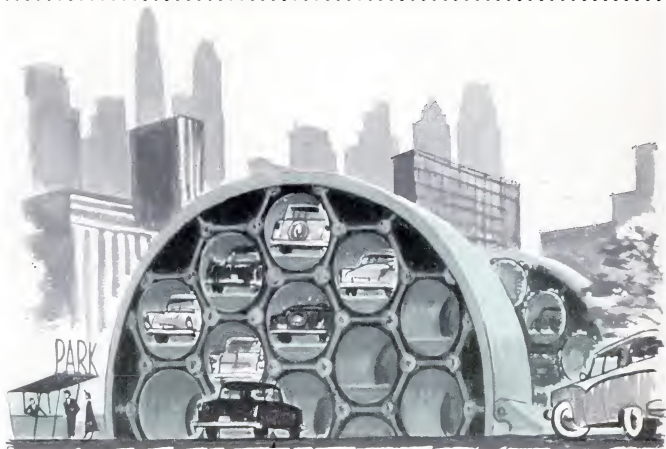
Meanwhile, what about Olie and Popeye? Well, they died—Olie on Easter Sunday, at the age of 22 days, from an inability to digest

turkey mash; Popeye a few weeks later, aged 18 days, cause unknown.

As for the Englishwoman's daughter, at last reports she was thriving but had flunked the crucial skin-grafting test.

Ordinarily, skin taken from one person cannot be successfully grafted on anyone else because the recipient's body sets up a reaction to it as foreign matter. Identical twins, since they developed from the same egg and have the same inheritance, are exceptions. Presumably a parthenogenetic child and her mother should be exceptions, too. But grafts from Monica to Mrs. Jones and from her to Monica did not hold permanently. So the doctors remain skeptical. END

New Ideas from the Inventors

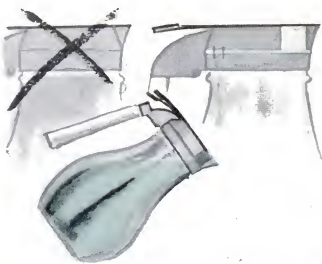


1 "Ferris Wheel" to Park Cars. This giant drum, honeycombed with rotating, self-leveling drums, might ease parking jams by stowing cars above and

below ground. By turning the outer wheel, an operator could quickly bring any of the parking compartments to ramp level for loading or unloading.

2 Fluid to Tighten Wrench. Instead of being turned by a screw, the sliding jaw of this wrench would be moved by a lever-operated hydraulic pump and pressure-release button. The fluid drive would insure firm gripping and speed the clamping and release action of the jaws.

3 Syrup Jug to Catch Drips. When you thumbed back the cover blade and tipped this pitcher, syrup would pour through a spout set slightly back from the lip. Drips left when you righted the jug would flow back in through a baffled opening forward of the spout.

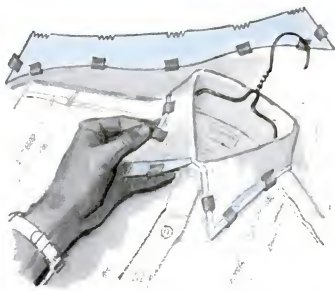


Please turn the page for more new ideas

More New Ideas from the Inventors



4 Riding Light to Defrost Mirror. Attached to a truck or bus, this illuminated side mirror would double as a clearance light. Heat from its bulb—radiated through a network of warm-air channels—would keep the mirror glass free of frost or condensed moisture.



5 Drying Form to "Iron" Shirt. If a shirt collar were stretched and clipped into this form while wet, says the inventor, it would dry to a smooth, wrinkle-free appearance. Similar plastic forms could be made to fit cuffs and other hard-to-iron garment shapes.

7 Bed to Hide in Ceiling. A guest-room bed occupies space all the time even if it's seldom used. However, a bed that could be power-lifted into an attic would

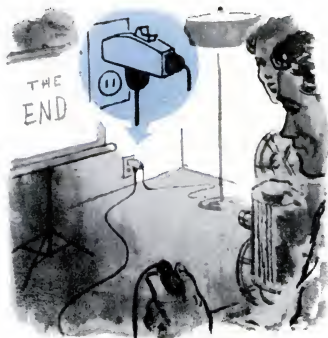
let you use the room for other purposes. The disappearing bed could also increase the daytime floor space in small but regularly occupied bedrooms.





6 Powered Piston to Raise Hood. This GM patent on a fluid-pressure hood lifter suggests that front decks may soon join the growing ranks of power-operated car parts. In addition to convenience, the piston lift would assure proper alignment of large, unwieldy hoods.

8 Cord to Stretch Switch. With this plug-in remote control you could switch a lamp, movie projector or TV from a distance. Any appliance connected to a wall outlet through the special adapter could be turned on or off as usual; for remote control, you'd plug the extension switch into the adapter.



9 Bow Props to Berth Ship. It is difficult to dock a large ship because at low speed the rudder has little effect against tide, wind and currents. This inventor would improve slow, close-quarter maneuvering by retractable screws in forward bulkheads. The bow props would propel and steer the vessel.

The following patents have been issued on these inventions: 1. Patent No. 2,706,054 to Thomas E. Morrison, Los Angeles; 2. No. 2,706,922 to Albert D. Allen, Memphis, Tenn.; 3. No. 2,676,472 to Frisk Paddock, Los Angeles; 4. No. 2,693,589 to William C. N. Hopkins, Portland, Ore.; 5. No. 2,692,710 to Mart E. Lee, Chicago; 6. No. 2,737,254 to George R. Bayley, Flint, Mich.; 7. No. 2,730,213 to Samuel and Emmaline Mason, Orangevale, Calif.; 8. No. 2,706,225 to Claud W. Freeman, Dallas; 9. No. 2,735,393 to Gerald C. White, Macon, Ill.

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington 25, D. C., at 25 cents each. To write to an inventor, if the address given above is insufficient, you may address him (by name and patent number) in care of the Commissioner of Patents.

What Women Want in That 'Next House'

THE clear voice of the housewife was raised at a Women's Congress on Housing held recently in Washington. It was agreed that if the men who design and build homes would only pay more attention to women's suggestions, house-keeping would be simplified. Some of the ladies' work-saving ideas are shown here. Also suggested was a "parents' room," isolated from the rest of the house and having its own outside entrance.



BUILT-IN BINS for toys in the children's rooms or playroom certainly would be welcomed by any mother, and would teach the youngsters to be orderly. Another idea would put a compartment into the tile alongside the bathtub for boats and other floating toys.



RAMPS should replace steps wherever possible. Aside from the convenience of wheeling a heavy shopping cart from garage to kitchen, they

would ease the chore of moving the vacuum cleaner or furniture about. Ramps are easier to keep clean than steps, too, said the ladies.



SEPARATE COMPARTMENTS for different types of clothes to be laundered would save time on washday. Placed on the wall above the washing machine and clearly labeled, they would

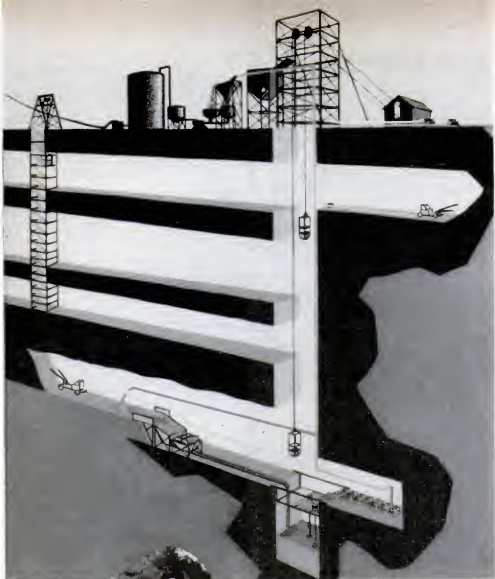
tell the housewife at a glance which lots should be washed in hot water and which in lukewarm water, and those that required longer or shorter washing cycles than average.



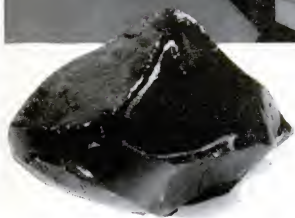
EASY-TO-CLEAN BATHROOM would have all fixtures of the type that hang from the wall, leaving an open floor space for mopping. The floor-resting legs or pedestals of a water closet, washbasin, dressing table and other fixtures, say the housewives, present awkward corners that make it much harder to keep a bathroom floor clean.



ENGINEERED CLOSET for cleaning equipment and supplies would borrow a home-workshop idea. An outline of each appliance would be marked on a wall to show where it goes. Shelves would be high and deep enough to take gallon containers of polish. The housewife should be able to remove any item without starting an avalanche of mop handles. END



GILSONITE MINE follows vein of mineral (black shading) straight down. In new mining method, hydraulic machines break ore loose. Water sluices it along horizontal mine tunnels to bottom of vertical shaft, whence it is raised to the surface. At left, below, is sample of the glassy black mineral. It has a specific gravity of only 1.04, making it barely heavier than water.



Novel mining methods, a pipeline for ore, and a new refining process combine to yield . . .

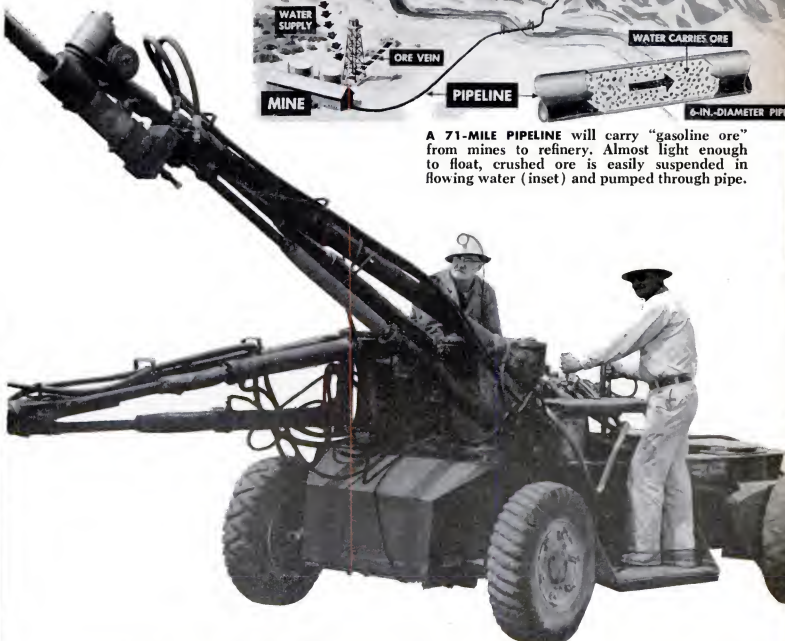
Gasoline from Solid Rock

A SHINY rock resembling black glass will become a new source of gasoline when a pioneering \$16,000,000 project goes into operation early next year. Undertaken by the American Gilsonite Company of Salt Lake City, Utah, the venture combines innovations in mining, transporting, and using one of

the most curious of all U. S. minerals.

Gilsonite, as the black material is called, is a remarkably pure form of natural asphalt. Solid veins of it measure up to 22 feet wide and extend hundreds of feet deep at Bonanza, Utah.

Pilot-plant trials have now perfected a way to convert this solid hydrocarbon



A 71-MILE PIPELINE will carry "gasoline ore" from mines to refinery. Almost light enough to float, crushed ore is easily suspended in flowing water (inset) and pumped through pipe.

MECHANICAL CUTTER DIGS ORE. Two movable arms apply rotary cutting spindles, whose spike-

like teeth spout water to keep the ore wet. Entire machine is hydraulically powered and operated.

into high-octane gasoline. The process also yields high-purity coke, valued as a material for the carbon electrodes used in making aluminum.

Unique hydraulic-powered machines have been developed especially to mine the brittle, sooty ore. One, a mechanical cutter, wields rotary cutting spindles bristling with carbide-tipped teeth. Another, a jet cutter, squirts high-pressure water into cracks to break ore loose. Water sluices the broken ore along V notches in mine-tunnel floors to the bottom of a vertical shaft. Then large chunks

are hoisted to the surface, smaller ones pumped aloft with water.

A 71-mile pipeline will carry the mined ore over an 8,500-foot mountain pass and, on suspension bridges, across two gorges to the refinery near Grand Junction, Colo. Gilsonite, crushed first to pea-size lumps or smaller, will be carried along the six-inch-diameter pipe in a stream of water flowing at 200 to 500 gallons per minute. At the refinery, a new "thermal cracking" process will convert the ore to gasoline and coke. —Alden P. Armagnac.



Motor lifeboats from shore caught the split tanker's crewmen as they leaped down from the hulks.

How This Ship Died

Stauncher than ever, the World Concord once more sails the seas—the only vessel in history to be torn in two by the ocean, and stitched together again.

I TURNED around on the bridge," said Capt. Nikolas Athanassiou, "and saw half of my ship disappearing away from me."

The *World Concord*, one of the world's biggest oil tankers, had split cleanly in two.

Bound from Liverpool to Syria, two years ago this month, the two-year-old vessel was sailing through heavy weather at the southern end of the Irish Sea. Huge waves beat at her.

At 1:55 a.m., Nov. 27, 1954, the 58-year-old master heard a strange, chilling sound, almost inaudible against the storm. As he looked backward he beheld a spectacle that, he well knew, had always meant the end of a ship.

For no vessel torn asunder on the open ocean had, in all the centuries of ship-

ping, ever before survived. Of the ships that had split apart at sea, sometimes a part of one had been salvaged, but more often they had simply sunk, or had become drifting derelicts.

But the *World Concord's* story was to have a different ending. Both her fore and aft sections were to be saved. She was to be put back together.

It was a job that involved almost insuperable problems. That these problems were solved makes the tale of the *Concord* unique in sea history.

Problem: The weather. Captain Athanassiou at once radioed for help both to rescue his men and for salvage. As he watched the stern first smash into the bow, then gradually vanish into the night, the weather got worse.

Athanassiou and the six men with him



The crewless bow half was driven relentlessly toward a rocky point, which it rammed broadside.

on the drifting, engineless bow were jounced by each wave like ice cubes in a giant cocktail shaker. There was a wild wind, and rain. Heavy seas raged over the deck.

Even the British Admiralty, which is given to understatement, called the weather "unprecedented."

Despite the weather, two tankers, a destroyer, a sloop and an aircraft carrier quickly responded to the *Concord's* calls. In those seas, they dared not, however, draw near the jagged halves of the tanker. Launching lifeboats was way beyond possibility.

The first job—to rescue the men—was one for shore-based motor lifeboats (PS, July '55, p. 106). Two—one from Wales, one from Eire—came out, got off all the crew. They did it by running close in, time after time, to the sections of the tanker, which they could scarcely see (visibility was about 100 feet), and having the men leap for the lifeboats. Athanassiou and those with him, the last to

be rescued, got off after 30 hours in their cocktail shaker.

Problem: There were now two crewless hulks being pitched over the Irish Sea. Each was making the speed of a full-rigged sailing ship with a fair wind behind her.

The hulks were being blown toward a rocky shore. A tanker is rarely free of explosive gas, and the *World Concord* (both halves) was full of it. Once on the rocks, the pounding might touch off

"THE DAMAGE SURPASSED BELIEF," said the *World Concord's* owners when they at last saw the underside of her bow. "From forward to aft on the port side, the whole bottom was missing."



After long, perilous voyages, the battered halves

sparks that could blow either hulk to smithereens. Any attempt at salvage, therefore, had to be made at once.

Jogging along through the storm that day was *Turmoil*, the late Capt. F. D. Parker commanding. The *Turmoil* is a rescue tug. She has 4,000 hp., displaces 1,630 tons loaded, is 205 feet long and is a deep-sea vessel expressly designed to haul (and save) the heaviest of ships.

Parker heard by radio where the stern of the *World Concord* was. He approached it. He called for volunteers to

tain, as inclined to understatement as the British Admiralty, have described his feat as masterful.

Meantime, the Royal Navy's small (596 tons) vessel *Cautious* attempted to tow the bow. Instead, the bow towed her toward the rocks. At the last minute, the *Cautious* had to slip the tow. The *World Concord's* bow ran aground broadside on the rocks off Ballyquintin Point, Northern Ireland.

Problem: To float the bow. After three tries (and three more storms), a salvage crew got aboard. They brought air compressors, sealed the tank vents, and filled the tanks with air. They also blew 6,000 tons of water out of the bottom (now lacerated by the rocks). Constant pressure of compressed air kept water from entering the hull and enabled the bow, 12 days after it grounded, to float free. A precarious bubble, it was towed to Belfast.

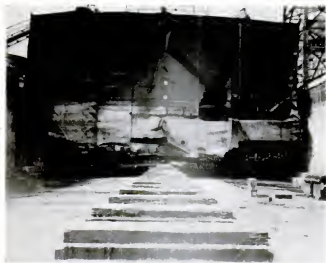
Problem: The *World Concord* now enjoyed the undesirable distinction of being in two ports simultaneously: Belfast and Glasgow. She had a further undesirable distinction: Neither wanted her. Their drydocks were not large enough. Or her repairs, if possible at all, would tie up the drydocks too long. Or she might explode—and there were other ships nearby.

The *Concord's* underwriters advertised for bids to put her together again. The lowest bid and the fastest estimated time were submitted, after many weeks, by the Mercantile Marine Engineering and Graving Dock Co., of Antwerp, Belgium.

The *Turmoil* again took the stern in tow. Again she encountered storms that sank other ships. At the end of half a mile of line, the stern veered time and again, like a kite on a string, almost 90 degrees from *Turmoil's* course.

But at the end of 12 days and 1,000 miles—on March 16, 1955—the stern reached Antwerp.

Other tugs, meanwhile, had waited for



FOUR MONTHS AFTER the disaster, which had occurred more than 1,000 miles away, the badly damaged bow rested in a Belgian drydock, where it is shown here, photographed from the rear.

board the careening stern, by launch, and got five of them and a towline aboard.

The waves were like moving mountains. The stern dangled a mass of debris. There was always the chance that sparks from clashing metal plates or even from the friction of the towline would explode the hulk.

Parker—trying to keep the stern off the rocks and looking for a lee shore to protect it from the gale—crossed and recrossed the Irish Sea. In 48 hours, traveling 300 miles the way he zigzagged, he got the stern into Glasgow. It was the first time Parker ever had picked up part of a ship at sea. Other tugboat cap-

reached Antwerp drydock

a favorable weather report and had begun pulling the bow to Antwerp. The bow, still kept afloat by compressed air, like a toy balloon, would have capsized in a light breeze. A capsizing would have destroyed the compressed-air bubble on which the bow was riding, the sea would have rushed in, and the bow would have sunk.

The favorable weather did not last. There were three unscheduled stops to take refuge. But after 20 days en route, on March 18 the bow entered Antwerp's harbor.

The *World Concord* now was all in one port, lying before the drydock that would attempt repairs. It was almost four months since she had broken in two.

Problem: She wouldn't fit the dock.

The bow section had been bulged out by the pounding on the rocks at Ballyquintin, with the result that it had become three feet wider than normal below the waterline.

Divers, using oxybutane and oxyarc underwater cutting torches, sawed away 40 tons of the protruding metal. The job was especially dangerous because of the jagged steel and the dark water in which the divers worked. They were stopped when it was estimated that there were three inches' clearance between the ship's sides and the drydock.

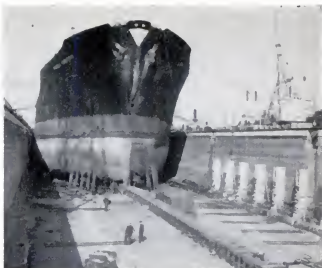
The bow was floated into the dock, and this estimate was found to be high. The actual clearance was 1½ inches.

Problem: As soon as the bow was floated into the dock, one of the worst messes in ship-repairing history occurred.

First, the bow collapsed the shoring that was supposed to support it and nestled right down on the bottom of the drydock.

Almost simultaneously, the *Concord's* fuel tanks began to rain down a storm of oil onto the scraps of shoring. The leaking tanks reeked with highly explosive petroleum fumes.

All repair work on the ship had to be



WHEN SHORING COLLAPSED, the tanker's bow had to be supported in a surer way. Sixteen tall concrete pillars were built along the walls of the drydock (above, right), eight to a side.



TO FIT OVER CONCRETE SUPPORTS, heavy steel brackets were welded onto both sides of the bow, which had to be refloated and edged in so that the brackets would cap the supports.



A NEW BOTTOM was needed for the bow, requiring prefabricated sections of steel. None were to be had in Europe, so the shipyard had to weld some—up to 24 tons in size—from flat bars.



Nine months after she broke in two, *World Concord* was whole again and better than before.

stopped until the mess was cleaned up.

An oil-separation barge came and removed the oil left in the ship—plus 80 tons of sludge from the dock.

The fuel tanks were cleared of fumes.

New concrete supports to replace the smashed shoring were built along the sides of the drydock. The bow was actually occupying the front, or open end, of the dock; the supports were built farther along toward the back end. To fit over the concrete supports, steel brackets were welded onto both sides of the bow. Then the bow had to be refloated and edged in so that the brackets would cap the new supports. In view of the fact that the bow cleared the drydocks by a total of only an inch and a half, and the bow, when floating, was still held up only by compressed air, any vibration from other work in the shipyard could have unsettled everything. So the work of moving the bow was done on Sunday.

Problem: As the bow was nudged slowly forward, it became apparent that the drydock's sides were not parallel.

This necessitated much cutting (where the dock's sides curved in toward the ship) and shimming (adding planks where the dock's sides curved away). But by four p.m. on that Sunday—it was now May 14—the bow had been gotten into place. At last the bottom was accessible, and men could get underneath to have a look and plan its repair.

Problem: There was no ship's bottom to be repaired.

"The damage surpassed belief," reported the *World Concord's* owners. "From forward to aft on the port side, the whole bottom was missing."

If this had been known from the start, the bow would have been junked and a new one built. But now a new bottom, composed of prefabricated sections of steel, had to be put on.

Problem: No prefab sections were available.

The British shipyard that had built the *Concord* could not supply them in time. No one on the continent of Europe made them to the proper specifications.

So the Antwerp shipyard had to weld together flat bars of steel to make its own. Sections as large as 24 tons were thus specially made. A 60-ton erection derrick was placed on the deck of the *Concord* to lower them into place.

Then the stern section was moved into the drydock, behind the bow; a new bottom section was put on the stern; and preparations were made for welding together the two halves.

Problem: It was now discovered that during the day the heat of the sun expanded the deck three-quarters of an inch in length, while dimensions at the bottom, which was in the shade, were not affected.

This meant that the welding had to be done at night. On a Saturday night all the first-class welders in Antwerp were assembled. Each was assigned a short

[Continued on page 238]

HOLY
BIBLE

REVISED
STANDARD
VERSION

NELSON

The Machine That Indexed The Bible

Teaching their giant electronic moron a special numbers game, engineers beat the time of scholars by more than 20 years.

By Gardner Soule

YOU'LL be able to buy, next spring, the first dictionary ever produced by a machine. The book—a fat volume of 2,000 pages—is the Concordance to the Revised Standard Version of the Holy Bible.

Its compiler is Univac, Remington Rand's biggest electronic computer.

A concordance is an alphabetical index that lists each key word in a book and tells you where to find it. With each word, the concordance lists a quotation: the phrase or sentence in which the word occurs.

The last previous complete concordance to a Protestant Bible was that of James Strong, published in 1894. Strong took 30 years to index the King James version.

A new concordance was necessary to the Revised Standard Version because in it there have been a number of changes in words and wordings to make the Bible more understand-

AT CONTROL PANEL, experts direct electronic computer that, at the speed of light, made latest concordance to the Bible.

able to modern readers. At the speed of light, Univac took 1,200 to 1,300 hours—instead of 30 years—to make the new index.

Speed was the big reason Univac was given the job. Another reason, from Remington Rand's point of view, was to open up a new field—the indexing of English text—to an electronic computer that had pre-



viously handled mathematical problems almost exclusively.

For all its one to over two million parts—depending on the size of the Univac a purchaser orders—the electronic computer is not, Remington Rand insists, a giant brain.

"It is," says Dr. Grace Murray Hopper of the company, "an extremely fast moron."

"It will, at the speed of light, do exactly what it is told to do—no more, no less."

THE man who first thought Univac might be told to make the concordance was the Rev. John W. Ellison, today 36.

Ellison, preparing for the Episcopalian ministry at Harvard, was of course drilled in the Bible. But unlike many divinity students, he also studied math—because he liked it.

At Harvard, Ellison saw Biblical scholars—"men with two or three doctor's degrees apiece"—sitting around sorting and comparing Biblical words.

His knowledge of math suggested to him that sorting and comparing was essentially a mathematical job. If, he figured, the words could be coded—changed into numbers—an electronic computer could compile a concordance without human errors.

Ellison took a day and half to draft a one-and-a-half page letter to Remington Rand telling how, in his opinion, Univac might go about making the concordance.

Remington Rand looked around for men to handle the project. You might have expected the company to select a matured executive with years of experience. This is exactly what it did not do. "An electronic computer," they tell you at Remington Rand, "violates all the rules of electronic engineering. By 40, you know the rules too well."

THEIR eyes fell upon John Graham, 27, and Al Bosgang, 25. Graham planned the overall steps of the job. Bosgang took the steps and programmed the major runs. This means that Bosgang

gave Univac its instructions; he was the man who told the machine how to make the concordance.

First step, the men knew, was to prepare the Bible so Univac could read it.

If Univac were a giant brain, like yours, they would simply have handed it a copy of the Bible.

But Univac, a moron, reads only one thing: metal magnetic tape.

The Bible therefore had to be put onto the tape. This was a typing job. Five girls, working in turns, hammered away on special typewriters, called Unitypers. It took the girls five months to transfer the approximately 800,000 words of the Bible onto four rolls of tape.

Even Univac's ability to read tape is extremely limited. It can read only figures, and then only two figures: 0 and 1.

When Univac startles the world by solving extremely complicated mathematical problems, it is only adding or subtracting 0's and 1's.

Therefore, the Bible appeared on the magnetic tape as a series of 0's and 1's. Different combinations of these two figures stood for each letter and punctuation mark in the Bible.

SINCE Univac, the moron, has no way of correcting a typing mistake, another set of tapes containing the Bible was made for checking. Ten other girls typed the Bible onto punched cards. These punched cards were fed into a machine called the Card-to-Tape Converter. From the cards, the converter transferred the contents of the Bible to four rolls of tape.

Now Univac itself, for the first time, went to work. Both sets of tapes were fed into it, and Univac compared the two sets of figures for discrepancies. This took five hours.

The mistakes were corrected, and a single, accurate set of four tapes containing the Bible resulted.

Next thing needed was a list of all the words in the Bible, giving each word and its location: book, chapter, verse, line, and place of word in the line.

A set of instructions was drawn up to

Like a Biblical scholar, Univac records complete quotations from Bible

| | |
|---------------------------------------|----------|
| BLOD TO A., AND ABOUNDING IN | JOE 2:13 |
| AND HIS A. TORE PERPETUALLY, AND HE | AND 1:11 |
| REPERT AND TURN FROM HIS FIERCE A., | JON 3:09 |
| BLOD TO A., AND ABOUNDING IN | AND 1:11 |
| AND IN A. AND WHATH I WILL EXECUTE | MIO 5:15 |
| NOT RETAIN HIS A. FOR EVER BECAUSE | AND 1:11 |
| THE LORD IS BLOD TO A. AND OF GREAT | NAN 1:03 |
| WHO CAN ENDURE THE HEAT OF HIS A.? | AND 1:11 |
| HAS THY A. AGAINST THE RIVERS, ON | HAB 3:06 |
| ODDST TRAMPLE THE NATIONS IN A., | AND 1:11 |
| UPON THE FIERCE A. OF THE LORD, | ZEP 2:02 |
| INDIGNATION, ALL THE HEAT OF MY A.; | AND 1:11 |
| WHO CAN ENDURE THE HEAT OF HIS A.? | ZEP 2:02 |
| AND IN A. HIS LORD DELIVERED HIM TO | AND 1:11 |
| AND HE LOOKED AROUND AT THEM WITH A., | AND 1:11 |
| HOUSEHOLD IN A. SAID TO HIS | AND 1:11 |
| A., BELFISHNESS, BLANDER, GOSSIP, | AND 1:11 |
| A., BELFISHNESS, DISSENTION, PARTY | AND 1:11 |
| LET THE SUN GO DOWN ON YOUR A., | AND 1:11 |
| AND WHATH A. AND CLAMOR AND | AND 1:11 |
| DO NOT PROVOKE YOUR CHILDREN TO A., | AND 1:11 |
| A., WHATH, MALICE, BLANDER, AND FOUL | AND 1:11 |
| WORDS WITHOUT A. OR QUARRELING; | AND 1:11 |
| BEING AFRAID OF THE A. OF THE KING; | AND 1:11 |
| NEAR, BLOD TO SPEAK, BLOD TO A., | AND 1:11 |
| FOR THE A. OF MAN DOES NOT WORK THE | AND 1:11 |
| UNMIXED INTO THE OUP OF HIS A., | AND 1:11 |
| ANGRED | AND 1:11 |
| WORDS, AND WAS A., AND HE SPOKE, | AND 1:11 |
| OUR FATHERS HAD A. THE GOO OF | AND 1:11 |
| THEY A. HIM AT THE WATERS OF | AND 1:11 |
| ANGLE | AND 1:11 |
| AT THE VALLEY GATE AND AT THE A., | AND 1:11 |
| THE AFFEY TO THE SHEDDY AT THE A., | AND 1:11 |

BIGGEST PROBLEM of the entire job was to make sure that the electronic computer put down complete quotations you would recognize. How well this was done is shown by the list above of sample entries for the concordance under the word "anger."

But there are many words in the Bible no one will ever look up. Examples: "a," "the," "is," "to." There are, Rev. Ellison concluded, 131 such words—and these words actually make up 59.6 percent of the contents of the Bible.

Instructions were prepared to tell Univac how to throw out the useless words, and put the others into a new list.

BACK into Univac went the 63 tapes containing all the words of the Bible. Out came 26 tapes containing the important words—the key words. It took Univac 10 to 15 hours to reduce the tapes from 63 to 26.

Now two sets of tapes were on hand: (1) four reels, containing an accurate Bible; (2) 26 reels, containing all key words plus their locations.

The problem—the most complicated of all—was how to tell Univac to list the exact quotation in which each key word

tell Univac how to compile this list. Like everything else Univac reads, the directions were put on magnetic tape. They were fed into Univac's memory.

This memory is the most amazing part of Univac, and is the thing that makes people call it, wrongly, a giant brain. It is that part of an electronic computer that receives, and retains, instructions.

The memory consists of a series of channels (like arteries and veins) with mercury circulating in each channel. Electronic pulses circulating through the mercury (like the pulse at your wrist) carry the instructions. The pulses in each channel tell Univac what to do with a particular combination of 0's and 1's.

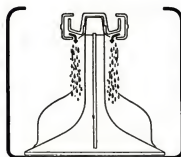
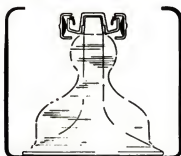
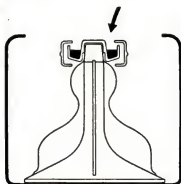
Back into Univac went the four corrected rolls of tape containing the Bible. Out flowed the list of words and information about each, on 63 rolls of tape. It took Univac 50 hours to compile the list—a list that would have filled 5,000 printed pages.

[Continued on page 242]

NOVEMBER 1956 175

New Aids to Living

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1 Dispenser wheel eliminates extra trips to the washer to add water softener to the rinse. The softener, poured in when the washer is loaded (top diagram), climbs the sides of the cup to an

outer container (center) as the agitator spins. Centrifugal force holds it there until the rinsing cycle when it falls through (bottom). The wheel fits all Norges and is standard on 1957 models.

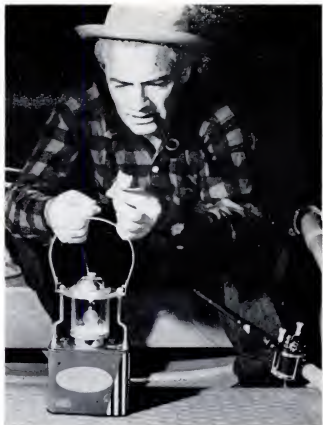
2 Portable waste disposer requires no special plumbing. Just plug it into an outlet and a steady stream of water from the faucet washes pulverized bones,

corncobs and other scrap down the drain. The unit won't operate if the lid is open, and it stops instantly if a knife or other metal object falls in. It costs \$89.95.





3 Kit converts windows so sash lifts out for washing. Metal strips screwed to the frame lock in the window and weatherstrip it, too. A catch releases upper and lower sash for quick and easy removal.



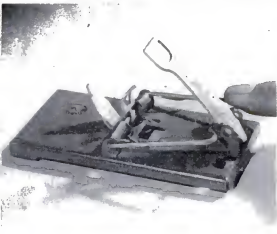
4 Sportsman's lantern perches piggyback on its power pack, held in place by two screw caps. The new two-in-one dry cell is said to last four times as long as ordinary lantern batteries.

More information about the products shown on these pages can be obtained from: 1. Norge Div., Borg-Warner Corp., Merchandise Mart Plaza, Chicago 54; 2. Free Sewing Machine Co., 336 N. Foothill Rd., Beverly Hills, Calif.; 3. Winsor Mfg. Co., 727 Allegheny Ave., Oakmont, Pa.; 4. Burgess Battery Co., Freeport, Ill.; 5. Patented Products Co., 214 E. 41st St., NYC 17; 6. Sheldon Sporting Goods Co., 270 Lafayette St., NYC 12; 7. Childlore Co., 331 Southwest Blvd., Kansas City 8, Mo.

5 Safer mousetrap won't accidentally nip the person who sets it. The trigger arm, more precisely hinged than on most traps, drops down over the release with a self-cocking action. Being made of steel, the trap does not retain any odors.

6 Chemical blotter has a thirst for oil and grease. Sprinkled over spots on cement, tile or linoleum floors, then swept up, it takes stains with it. Set out in open containers in basements or closets, it drinks up moisture, halts mildew.

7 Furniture coaster can support a grand piano and not leave a mark on the carpet. More than 100 tapered plastic teeth push aside the pile without crushing the fibers. Weight is distributed over the cup so that the teeth never pierce the backing.



Gus Joins the Rescue Squad



A rumor, like a fire, proves a lot easier

By Martin Bunn

GUS WILSON, after a hard day in the Model Garage, was in bed when he heard the fire sirens. A strong wind was blowing, and Gus decided it must be a chimney fire. He was almost asleep when the phone rang.

"Mr. Wilson—" the voice was on the edge of hysteria—"this is Amelia Brown. They're saying my son, Tommy, set fire to the creamery."

"What!" said Gus. "But Amelia—what can I do about it?"

"I know," Mrs. Brown said apologetically. "I guess I'm all flustered. You see, it's an awful fire and Mike Pagett is trapped in the ice tower. Tommy phoned me about it and said I should call you. You know, Tommy hasn't any father..."

"Where are you, Amelia?" Gus's voice was sharp. "Where's Tommy?"

"I'm at home. I don't know where Tommy is. The police called..."



Looking upward, they saw the youngster clinging to the moving conveyor, already out of reach.

words, yet vaguely understood. A fatherless boy who had been forced to help his mother scramble for a living ever since he had been in knee pants might turn in time of trouble to a man who had given him an occasional word of encouragement through the years.

WHEN Gus drove up to the creamery he was appalled by the sight. The old wooden structure was a mass of flames. Every piece of fire-fighting equipment in town was gouting water into the inferno. A crowd of onlookers was milling about and Officer Jerry Corcoran had his troubles keeping the way clear for the firemen. Fire Chief Captain Jerome Maloney was directing operations in a voice that rose to a bellow above the wind and crackling flames.

"It's bad, Gus," Jerry Corcoran said as Gus fought through to his side. "Mike Pagett's trapped up there."

Gus's eyes followed Jerry's pointing finger, to where a small building was perched high above the roof of the creamery on wooden stilts. Gus knew its purpose. Behind where he stood was the ice-making plant of the creamery. Here huge ice cakes were made, crushed and sent up to the ice tower by an endless conveyor belt, which was mounted on a wooden, spidery structure. The crushed ice was dumped into a vat in the high building where Mike Pagett was trapped. Sheet-iron tubes led down to

to start than stamp out.

"Stay where you are until you hear from me," Gus said, leaping out of bed. "I'll go right down to the creamery and see what I can do."

When Gus ran out to his car the wind hit him like a solid wall. There was a red glow in the direction of the creamery. As Gus drove he asked himself why Tommy Brown, of all persons, should have insisted that his mother call Gus Wilson. The answer to this question was one he found that he couldn't put into

various parts of the creamery. By opening these tubes, Mike Pagett, maintenance foreman of the plant, could deliver crushed ice by gravity to all parts of the creamery, for use in packing ice-cream tubs for shipment and other purposes.

"Jerry," Gus said as the situation struck him full force, "we can't just stand here and let a man die. We've got to get Pagett down from there, some way."

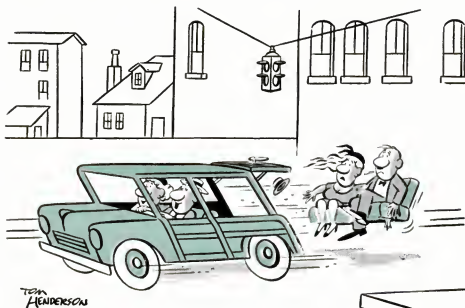
"How?" Captain Maloney spat out the

"No," Corcoran agreed, "it doesn't. But Tommy got a bit riled at Mike. Before witnesses he told him he'd like to see him burn. Tommy could face a manslaughter charge. We've got men out now looking for him."

"We can't let Pagett burn," cried Gus. "How about that conveyor chain? Couldn't we send a man up it to Mike?"

"We've thought of that," Captain Maloney said. "I'm not going to trade one man's life for the bare possibility of saving another. The conveyor only runs one way—up. Even if one of my men could ride it up, how would he get down again with an unconscious man in his arms?"

"We'll see," Gus said, and he was running for the ice plant.



"Watch the pickup on this baby!"

one word. "How, Gus? We didn't know he was up there until he appeared at the window. The roof below the ice tower was already aflame. We tried to put ladders up to him but it's too high—and too hot. We shot a rope up there but by that time Pagett had collapsed."

Maloney leaped to where firemen were directing twisting, writhing hoses toward the ice tower.

"WHAT about Tommy Brown?" Gus asked Corcoran.

"Tommy quit school last week," Corcoran said, "so he could take a full-time job here. Tommy was green at the work, I guess, and Mike Pagett's an impatient man. He fired Tommy this morning. I guess it hit the kid pretty hard, Gus."

"That doesn't necessarily mean he set fire to the place," Gus protested.

veyor belt. The motor began to hum and the endless conveyor belt started clacking away on its sprocket wheel.

Gus stooped and removed the cover from the wiring junction box at the base of the motor, and inspected the metal number tags on the wires. Maloney came to join him.

"If you send a man up on the conveyor," Gus told him, "I can switch the wiring on this motor and reverse the direction of its rotation. That will make the conveyor run down instead of up."

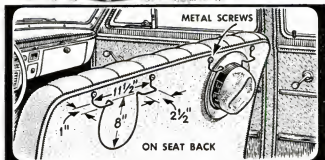
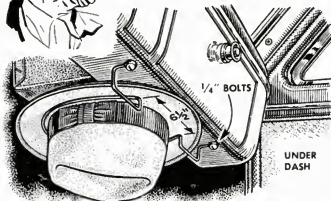
"Are you sure, Gus?" Maloney asked doubtfully. "If I send a man up into that inferno, there won't be any time for fiddling around with wires. Once he dives in after Pagett we'll have to get him down, and fast."

"We will," Gus said grimly, "if the

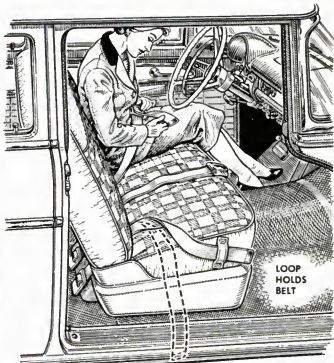
[Continued on page 232]



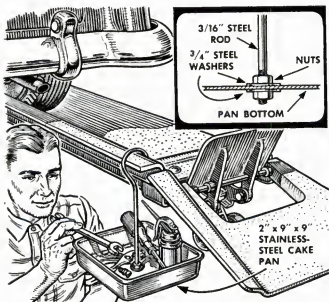
Hints from the Model Garage



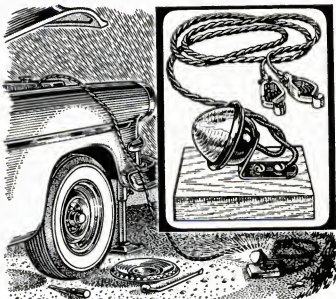
Your best hat won't get sat on if you stow it out of the way in a holder. Coat-hanger wire will do for back-of-seat holders, but hard No. 9 wire should be used under the dash to support the hat.



Keep safety belts from dropping out of the car by tucking the ends of the outer straps into loops stitched to the ends of the seat. The belts will stay cleaner, and won't get pinched by the car door.

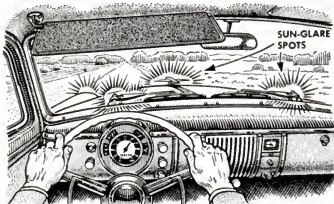


A hook-on tray hung within reaching distance will save fumbling for tools or parts while working under a car. The tray shown is kept stocked with wrenches and extra fittings for a lube job, saving the garageman many steps. On a repair job, the tray could hold small parts.

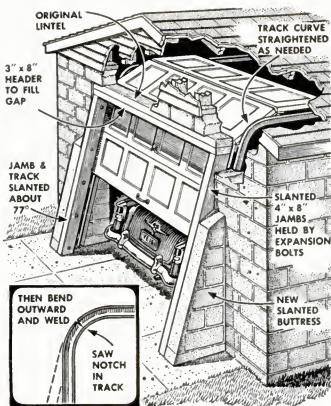


A compact trouble light can be assembled quickly using a truck clearance light, 15 feet of wire and a pair of battery clips. Bend the bracket to aim the lamp upward and screw it to a small block of wood. Having no batteries of its own, it won't be dead when you need it.

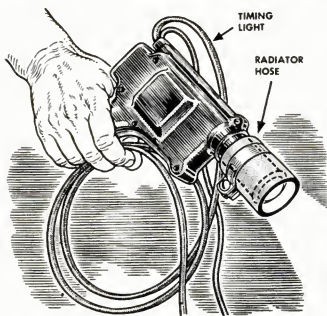
More Hints from the Model Garage



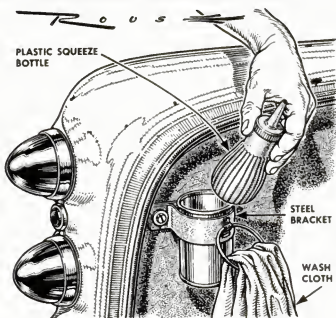
A TV trick is to coat bright objects with a non-reflecting film to keep glare out of cameras. Next summer, or when driving south this winter, you can soften glaring reflections that bounce off chrome parts into your line of vision by coating them with liquid car cleaner. The white powder rubs off easily at the journey's end.



You can add footage to a garage that has the type of door shown. Remove the door jams, notch the track where it curves and bend it out so that the door clears the car's bumper. Add an extra header to close the gap at the top of the door and reset the jams to suit the track. Finish with slanted buttresses to match garage.

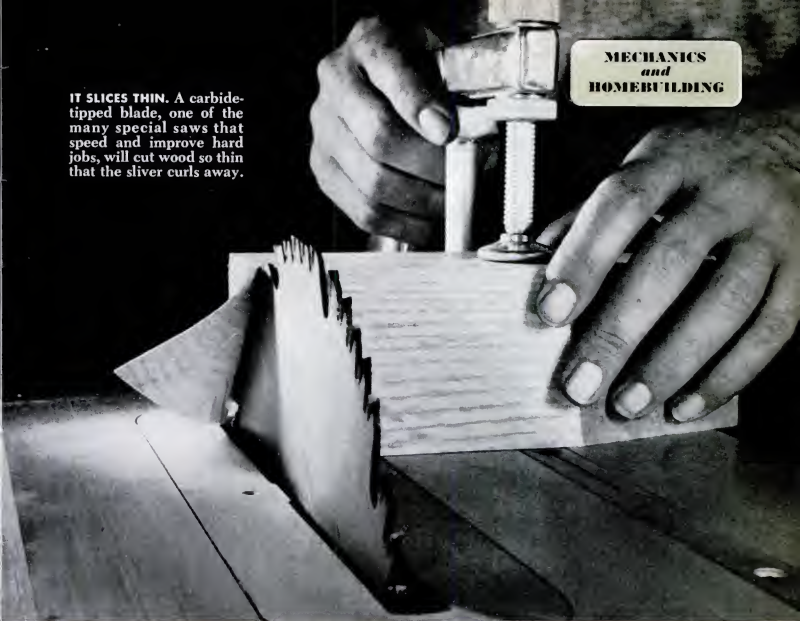


A short piece of radiator hose clamped over the lens end of a timing light will protect the light from being shattered if dropped or accidentally touched against a rotating fan blade. Paint the inside of the hose white to help throw light.



Stow a plastic squeeze bottle in a tin can screwed to the side of your car's trunk. Filled with windshield cleaner, it is convenient for keeping windows clear on a trip. In winter, fill the bottle with a defrosting solution to remove sleet.

IT SLICES THIN. A carbide-tipped blade, one of the many special saws that speed and improve hard jobs, will cut wood so thin that the sliver curls away.



Facts you should know about

Better Blades for the Circular Saw

By R. J. De Cristoforo

INSTEAD of the compromise, combination blade usually found on a circular saw, you may prefer to have:

- A blade that leaves the cut edge so glass-smooth it looks sanded.
- A blade so cheap that you throw it away rather than sharpen it.

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THE AUTHOR of this article is well known to craftsmen everywhere for his do-it-yourself best seller, Power Tool Woodworking for Everyone, which has sold over 100,000 copies in three years.

• A blade that is less likely to feather or tear out wood at the end of the cut.

• A blade that keeps kerf loss to a minimum for fine decorative work.

Specialty blades that do all these jobs, and more, are not as well known as they should be. They'll make fine cuts in tough materials—plywood, plastics and hardboard—without chipping and chattering. They'll even cut brass and other nonferrous metals.

Cost a lot? Not necessarily. Special blades do cost somewhat more than ordinary ones at the beginning, but they last

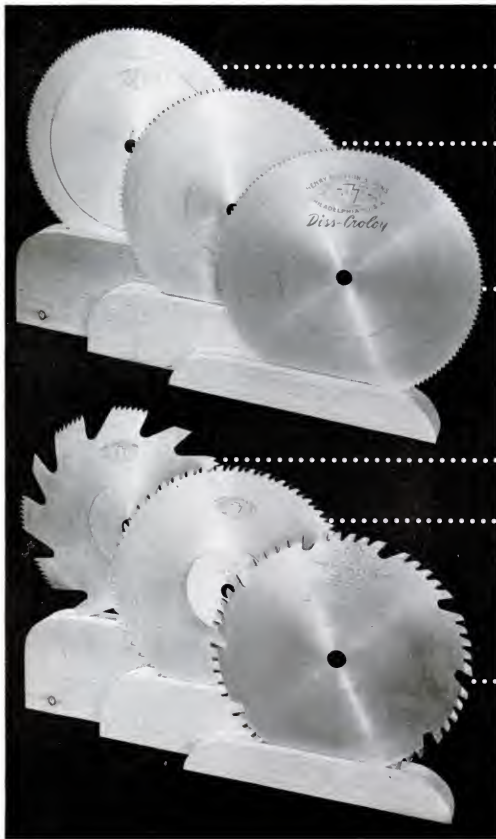
many times longer and pay for themselves in fewer sharpenings.

Special blades also pay off in the time and work that you save in cleaning up ragged cuts. Ripping and crosscutting are two entirely different operations. When you cut across the grain, the blade should shear the fibers with alternating face bevels that have knifelike edges. In ripping, the teeth should act like chisels, with deeper gullets between them to clear out waste.

A combination blade that only half shears and half chisels can't do either job well. Often it can serve, however, for rough cutting and to save blade changing. Then, instead of investing in ordinary rip and crosscut blades, you might want to put the money in a special blade to do really fine work.

Super-smooth cuts. Not even a regular crosscut blade, for instance, can give you the glass-smooth finish that a smooth trimmer can. This blade is made espe-

10 SPECIAL BLADES



1 THIN RIM has thick body for stability, thin rim for fine veneer, inlay and grooving work. Dealers may not stock it, but can put in an order for you.

2 PLASTICS BLADE is hollow-ground, but has teeth that can be set slightly if needed. For smoothest cuts, you'll probably want to use it without set.

3 METAL-CUTTING BLADE of high-speed steel stays sharp long, but can't be set or filed (must be reground). Run it slower than for wood-working jobs.

4 GROOVING BLADE looks like outside blade of dado cutter, comes in various fixed thicknesses. Use it if you cut a lot of grooves of the same size.

5 SMOOTH TRIMMER is best for fine cross-cutting and mitering and for all cuts in plywood. Don't use it for heavy rip cuts as the teeth will heat.

6 CARBIDE-TIPPED blade with 50 teeth lasts longest, makes fine cuts in all materials. Others have fewer teeth, but also cut well and wear long.

cially for fine crossgrain and miter cuts and eliminates feathering or tearing at the bottom or end of the cut. You can also use it on plywood and for good rip cuts in clear, soft woods or in hard woods if the cut isn't too deep.

The smooth trimmer is usually a heavy-gauge blade and on a small saw it may be underpowered. An 8" to 10" blade should have at least a ¾-hp. motor.

Plastics are stubborn. Plastics are so hard to saw that a friend of mine was

making all his cuts oversize so he could sand away the chips and chatter marks.

With a special plastic-cutting blade, you can make cuts so smooth that only a small amount of buffing is needed to bring the edges to a high polish. The blade is hollow-ground so that its straight teeth cut more cleanly than the set teeth on flat-ground blades.

Cutting metal. Blades made for sawing nonferrous metals (not iron or steel) have a special high-speed steel alloy that

FOR CIRCULAR-SAW JOBS

BUYER'S INFORMATION ABOUT THESE BLADES

| BLADE | MANUFACTURER AND IDENTIFICATION | PRICE | | | |
|-------------------|---------------------------------|---------------------------|---------|---------|---------|
| | | 6" | 8" | 9" | 10" |
| 1 THIN RIM | Disston | | \$ 4.45 | \$ 6.20 | \$ 7.95 |
| 2 PLASTIC CUTTING | Disston (¼" gauge) | \$ 8.32 | 10.01 | | 23.49 |
| 3 METAL CUTTING | Disston DiscoIoy | 13.78 | 21.18 | | 38.12 |
| 4 GROOVING | Disston | 12.32 | 16.10 | | |
| | | 21.02 | 28.31 | | |
| 5 SMOOTH TRIMMER | Disston Style P | | 17.10 | 22.03 | 22.03 |
| 6 CARBIDE TIPPED | Disston Style S | | | | 79.20 |
| 7 DISPOSABLE | Rocco Roc-Edge | 1.49 | 1.69 | | |
| 8 DISPOSABLE | Heinemann Hard-Tip | Type C combination | 2.35 | 3.00 | 3.75 |
| | | Type M crosscut and miter | 3.49 | 4.55 | 5.82 |
| | | Type P planer | 3.80 | 5.20 | 6.45 |
| 9 PLYWOOD CUTTING | Heinemann Plysaw (3/32" gauge) | 14.41 | 21.96 | 34.48 | 37.24 |
| 10 METAL CUTTING | Heinemann (1/16" gauge) | 13.37 | 20.54 | 30.18 | 32.12 |

NOTES: The blades shown are representative types in each classification and are NOT intended to represent all manufacturers of saw blades.

The prices listed above are those quoted by the manufacturer at the time of publication and may be subject to change without notice.



7 DISPOSABLE BLADE stays sharp three to five times longer than conventional blades, can be discarded when it becomes dull.



8 ALSO DISPOSABLE, this blade can be resharpened at least once, however, to give it longer life before you throw it away.



9 PLYWOOD BLADE also cuts smoothly in plastics and laminates. Bevel-ground, it must be returned to factory for sharpening.



10 METAL-CUTTING BLADE saws brass, bronze and other nonferrous metals. Holes distribute oil to the teeth for cooler running.

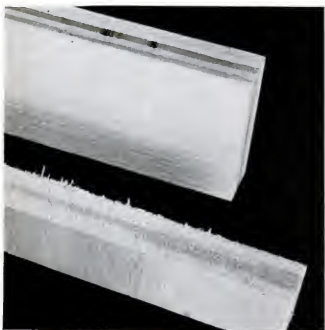
Special blades cost more but do better work



SO SMOOTH IT LOOKS SANDED, the top crosscut was made by a smooth trimmer blade. Note the rough, feathered and chipped edge on the lower one, made by a regular combination blade.



A CARBIDE-TIPPED BLADE made the heavy rip cut at top, a combination blade the rough lower one. Blade chatter caused the concentric arcs.



A PLYWOOD BLADE made the smooth cut at top. A combination blade chewed out the lower one.

keeps a keen edge even in brass, bronze and heavy aluminum.

Blade thickness and the number of teeth vary with the thickness of the metals to be cut. For average use, they should run about 1/16" thick with 100 teeth for a 6" blade to 3/32" thick with 150 teeth for a 10" blade.

Here the extra advantages of special blades begin to show up. The metal-cutting blade, for example, will also make good cuts in plastics, plywood, veneers and other problem materials. The plastics blade, if that's your meat, makes fine cuts in plywood and veneers.

A special for plywood. If you do a lot of work with plywood, especially in

NEXT MONTH:

You'll want to read about multiple sawing, a circular-saw trick that will enable you to make cuts much, much faster.

the fancy hardwood grades, you'll want to know about the plywood blade. It's not cheap (about \$35 for a 9" blade), but produces extremely smooth edges.

Do not use this blade to cut material over 1 1/2" thick or for fast ripping. You can, however, use it on plastics and laminated materials besides plywood.

Decorative work. Often you may want to cut very fine grooves for inlaying or decorative fluting, but your ordinary blades make too wide a cut.

The thin rim blade is made just for this. Its teeth are very tiny and thin so that they take very little wood out of the cut. It should never be fed fast, forced, or used for heavy cuts.

Cutting grooves. Grooving blades work something like a dado cutter, except that they aren't adjustable. Each blade is made to the width of the groove you want, say 3/8" or 1/4" wide. They're fine if you need a lot of grooves of the

Delicate jobs you can do with a thin-rim blade

same size, but they are fairly expensive.

Disposable blades. Here's a different kind of special blade—special because you throw it away when it's worn out. Most types have hardened teeth that wear longer than conventional teeth but can't be resharpened. They're cheap—scarcely more than the price of a sharpening job—but you'll find them only in the standard types.

King of them all. Carbide-tipped blades are by far the smoothest cutting and longest wearing that you can get. The best, with as many as 50 carbide teeth, can cost you up to \$80 and will stay sharp 100 to 500 times longer than ordinary blades. They cut all kinds of materials, including nonferrous metals, plastics, plywood and hardboard.

You can also get carbide blades with fewer teeth—8, 14, 16 and 20—for as low as \$8 to \$20. These do not cut as smoothly as the costly ones, but are good for thick stock, heavy rip cuts, and tough, abrasive materials. And they'll last you 20 to 25 times longer than ordinary blades.



FINE TEETH shave off thin strips for inlaying without wasting wood. For support, it's best to make a special table insert of plywood or hardboard and raise the blade to cut its slot.



DECORATIVE GROOVES with smooth, clean sides and flat bottoms are easy. The rim is considerably thinner than the body of the blade.

8 Good Rules for Circular-Saw Use

1 Be sure that the machine is in good running order with all the parts, such as rip fence and miter gauge, in correct alignment.

2 Be sure that the machine is not underpowered for the types and sizes of blades you want to use on it. For instance, don't try cutting with a 10" blade driven by a ½-hp. motor.

3 Never force a cut. Saw blades are designed to cut just so much, and excessive feed pressure overloads the teeth, causing stalling, chatter and fast dulling. Feeding slower than the blade will take produces smoother cuts.

4 Use the correct blade for the job at hand. A hollow-ground blade, for example, should not be used for rough sizing operations, only for trim cuts and mitering.

5 Keep blades clean. Dip them in a solvent occasionally and clean away accumulated pitch and gum from the teeth.

6 Run each blade at the speed that the manufacturer recommends.

7 Use the correct blade projection. A high blade projection is actually more efficient and consumes less power than a low one, although it is not the safest. On hollow-ground blades, the projection should be greater; otherwise, the lack of teeth set may cause the blade to burn. Because of this, don't use a hollow-ground blade for any kind of grooving operation since the teeth will be confined within the wood.

8 Be sure the blade is sharp. A dull blade is both inefficient and dangerous.

How a TV Repairman Broke Up a Racket

By Art Margolis

TO THE TV set owner, a twisting, weaving picture means only that he can't enjoy his shows and is in for a repair bill. But to me, the repairman, those seemingly senseless squiggles are often the tip-off that puts a finger on the trouble. One of these jobs even provided the clue that put the finger on a couple of suspects and broke up a furniture-stealing racket. You could call it . . .

The Rainbow Spaghetti Caper

"IF YOU can identify that TV set," said the burly police sergeant, "we can put two guys where they won't see TV."

The line-up consisted of a single 12" Emerson and two unhappy characters I'd never seen. There wasn't a scratch on the TV to set it off from all others of the same model. Only when I pulled out the chassis did things come back to me.

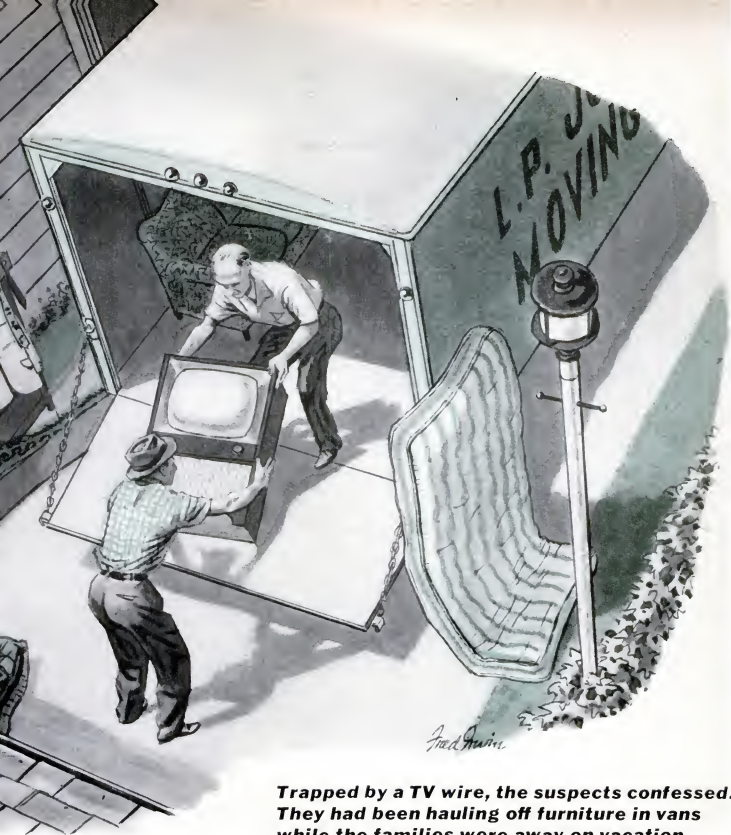
A few weeks before, an old customer had called me to repair such a set. Its picture was perfect at the bottom, but grew darker from there up until it was completely blacked out in the center.

Brightness—the light on the tube face—is caused by a beam of electrons sprayed



across the screen line by line from top to bottom. This light-spray pattern is called the raster.

But it's light, not a picture. To make one, you must have contrast—the screen must be dark in some areas, less so in others, bright in still others. The TV station provides this contrast in the form of varying voltage (called the video or picture signal) which is applied to the electron gun in the tube. The less voltage,



Trapped by a TV wire, the suspects confessed. They had been hauling off furniture in vans while the families were away on vacation.

the brighter the spot the electron beam hits; the more voltage, the darker.

In this 12-incher, the vertical sweep signal that pulls the beam down the screen was leaking through a shorted condenser into the electron gun. Since the sweep signal is strong at the top of the picture, it blacked out the image there. As it got weaker farther down, the picture came in. I fixed the set by replacing the bad condenser.

A few weeks later my customers returned from vacation to find almost all their furniture gone—apparently the work of “The Empty House Burglars.”

The police picked up a couple of suspects. They failed to trace any of the furniture, except a TV set like the one taken from my customer's home. The suspects swore they had bought this from an out-of-town friend.

I was able to show the sergeant the

condenser I had changed. The original had been a 400-volt; mine was a 600. I had soldered it to a different tie point than the manufacturer used. As a clincher, there was my own rainbow-colored spaghetti on the condenser leads, with not another piece like it in the set.

Confronted with this, the suspects confessed that they had been backing up a moving van to homes while the occupants were on vacation and moving everything out. This caper earned them a trip, too—to the state pen.

The Rock-'n'-Roll Bounce

AT A teen-ager hangout, a 19" set was star of the floor show. The local TV station featured a disk jockey every afternoon. Between pops and sundaes, the after-school set made a big thing of dancing to his patter and platters.

I was called in because the set had developed an offbeat bounce and roll. When it did lock in, the picture hung an inch from the bottom of the screen, and white retrace lines shone through it.

The vertical sweep signal that pulls the electron beam down the screen 30 times a second must be exactly synchronized with a like one in the TV camera, or the picture will flop over or roll. So the station sends a vertical locking pulse along with its signal. In the set, this pulse is peeled off and sent to the vertical oscillator to key it in.

A condenser in the separation stage of this set had shorted, distorting the locking pulse. Instead of tying the picture neatly in place, it was letting it slide up off the bottom. Installing a new conden-

ser brought in a good picture. But the little redhead looking over my shoulder put on a doleful face.

"So what's wrong with that?" I asked.

"You stopped it, mister," she pouted. "You played it strictly square. If only you'd timed it with the tune, we'd have had the liveliest rock-'n'-roll in town."



The Set with the Bricklayer's Bend

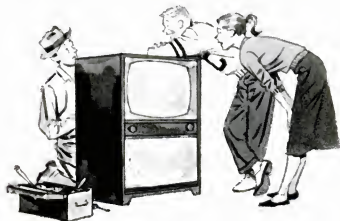
MY NEIGHBOR, a master bricklayer, and his wife are the kind of people who borrow a cup of sugar and return a five-pound bag. He was already one favor up on me, so when my family wanted to build a brick barbecue in our yard, I persuaded them to wait until the neighbors went on vacation.

I cast the foundation, but then came a busy streak at the shop. My wife laid some bricks, I added a course or two when I could, she started on the chimney, and so on. When the neighbors returned, the barbecue had been started in several places and finished in none. It looked like a futuristic ruin.

The bricklayer promptly offered to build it, but I pretended eagerness to do it myself. The next day he offered again, a bit more persistently. The third day he almost begged to do it.

My wife found out why. His wife told her that their TV set had developed a bad bend at the top of the picture since they had come home. The bricklayer knew about TV waves bouncing off buildings (which *can* cause ghost images). He was convinced that his aerial was getting its signal distorted by our odd barbecue.

That Saturday I saw him go out, in working clothes. After an hour or so I



went over. His wife rather dubiously let me come in to check their set.

To draw the 525 lines that form each picture frame, the electron beam must be swept across and whipped back for the next line in exact time with the scanning beam at the transmitter end. If the set's sweep is out of time, the picture is distorted. So the station sends a horizontal locking pulse at the end of each line to lock in the set's horizontal oscillator.

This is similar to the vertical locking pulse but occurs 525 times as often. Being higher in frequency, it is harder to isolate and requires a more critical separation circuit. In this I found two balanced resistors that had shorted down in value, letting the vertical pulse ride into the horizontal one. Since the vertical comes only once per picture field, it was bending only the top of the picture.

Installing two new resistors, I got a good picture and reflected that I was at last even with my neighbor. As I opened the door, I almost bumped into him.

"It'll be okay now," we both said.

I stared at him, and he looked at me. The only way to break it up was to show him the set. It worked fine. He thanked me, but seemed not at all surprised.

As I cut through the back yard to go home, I found out why. There, expertly built and completely finished, stood our red-brick barbecue.

The Candid TV Camera

TALES I'd heard about its boss made me a bit jittery when I got a call from a big industrial plant that had a closed-circuit TV system. The big wheel was a hard-driving character who had worked his way up as an efficiency expert.

He'd installed a TV set in every department and a master camera in his office so that he could deliver pep talks without pulling people off their jobs. I wondered if he'd breathe down my neck with a stop watch while I traced the trouble.

Sure enough, he gave me a 30-second lecture on efficiency, winding up briskly: "Give it a thorough check. Leave your



bill with the cashier. Don't look for me. I may be needed almost anywhere."

You got the impression that not a wheel could turn without him. I got out of his office fast. The defective set was in a distant department. Hooking rabbit ears to it so as to get a broadcast picture, I found two symptoms: a varying buzz in the sound, and dark bars ripping over the picture in time with the sound.

The buzz I diagnosed as part of the picture signal getting into the audio, and the bars as sound in the video.

Sound and picture are transmitted on the same carrier wave, but the picture is sent by varying the amplitude or strength of the signal (AM, like ordinary radio) and the sound by modulating the frequency (FM). These two modes of transmission are supposed to keep the audio and video separate. But in this set they were getting scrambled.

Looking for the cross-leak, I found a bad filter condenser in an output circuit from which both sound and picture drew power. The filter had broken down and was no longer acting as a barrier.

With a new condenser, I found the set worked fine on regular TV stations pulled in on the rabbit ears. As a final check, I called the switchboard and asked the girl to turn on the closed TV circuit.

Instantly a loud saw buzz roared down every corridor in the plant. As I ran back to the set, wondering what bloopster I could have pulled, the buzz was drowned out in gales of laughter.

The set was working fine. From the big wheel's office, the master camera was transmitting a crisp, clear picture. It showed that human dynamo, the efficiency expert, with his shoes off, feet on the desk, sound asleep and snoring. **END**

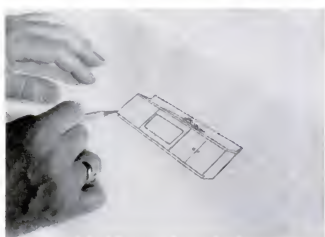
New for the Handyman

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1. Jelled Paint Comes in Tube. You can put enamel on a brush, just as you squeeze on toothpaste, with jelled paint that is now packaged in tubes. A large tube holds enough to cover about 40 sq. ft., a smaller one half that area. The tubed colors won't run or drip like other paint, but spread like a liquid when applied.



2. Holder Handles Can and Brushes. Here's a spring clamp with a handle that grips both your paint can, up to a quart size, and brushes—all the drip going into the can. With it you can keep brushes of different sizes right at the work and change from flat surfaces to trim almost instantly. The swivel carrier also parks several brushes in a can or jar of solvent.



3. Plans Made in Perspective. If you want to show your wife—or a carpenter—how a home-improvement job should look when finished, you can draw it in perspective with this kit. Each package contains a series of grids that represent interiors and exteriors, including corners, and a supply of tracing paper to be used over the grid that suits your purpose.

4. Plumbing Parts Are Pre-cut. Flexible plumbing supplies, which you can bend by hand to the right shape, now come on cards which also carry complete installation instructions for the parts you buy for the job. Pre-cut lengths of tubing and the right connection for the installation eliminate cutting, threading and the need for special tools for many home jobs.

More information about these products may be obtained from: 1. American-Marietta Co., 101 E. Ontario St., Chicago 11; 2. Roplin Accessories, 207 Moseley Rd., Birmingham 12, England; 3. T. Doman & Co., 11 Moss Ave., Highland Park 3, Mich.; 4. Plumb Shop, 1341 Temple, Detroit 1.

An old-time finish is gaining renewed favor. But this time all the colors are in one can.

Now You Can Spray Spatter Paint

By Bernard Gladstone

THERE used to be an old gag about the not-too-bright homeowner who tried to buy a can of striped paint. Stripes haven't been perfected yet, but new enamels that give a color-flecked, textured coating have. Two or more colors can be applied in a single spray coat. The result is an effect like the spatter finish that was popular in Colonial days. When dry it forms a tough, scratch-resistant surface that can be scrubbed



with scouring powder if necessary, and that is virtually chip-proof.

Introduced eight or nine years ago, one-coat spatter paints quickly won acceptance for spraying walls, ceilings, and woodwork in commercial buildings and housing developments. Later, use spread to the manufacturing field for such products as store fixtures, nursery furniture and kitchen cabinets. Now the enamels are being packaged and sold for home use. They are somewhat more expensive than regular paints and are best used on furniture, cabinets and other small projects where the cost won't run high.

What makes the spatter? These multicolored paints consist of a solid color enamel to which have been added flecks of a contrasting paint that is not compatible with the enamel. Therefore, they do not blend in the container. Most dry to a dull, semigloss finish, and are made for interior use only. Those for exterior use usually dry with a higher gloss. All are designed for spray application only.

One-coat spatter paints must be carefully handled. Most will not last more than three or four months when stored unopened in the original container. Once opened their life is even shorter. During cold weather the paint must be kept indoors; freezing will ruin it.

What sprayers to use. Internal-mix spray guns used at low pressure work best. Air in the cup forces the heavy mixture up through the paint tube and out on the work in a coarse spray—the coarser the better. Vacuum-cleaner spray attachments and hand insecticide sprayers that build up pressure in the reservoir as they are pumped also work well.



WHERE ARE THOSE PLIES? One easy pass with a spray gun and a single coating of the new spray-on spatter paint conceals the plies that show on the edge of this piece of plywood.

Brushes are out—one-coat spatter



VACUUM-CLEANER ATTACHMENT. To get the coarse spray required for the new spatter paints, these little guns are hard to beat. They're cheap, and you can get them for most tank-type cleaners.

External-mix spray guns and vibrator-type guns atomize the paint too fine to achieve the spatter effect.

For the homeowner, the ordinary vacuum-cleaner spray attachment is a good bet. However these do not give as much control as can be obtained with a conventional adjustable spray gun. Hence the results will not always be as uniform on a large area. To use an attachment, first make certain you detach your vacuum-cleaner hose and re-attach it at the exhaust end of your cleaner so that the air is being blown out rather than in. Remove the dust bag and let the machine run a few minutes to blow out dust.

Spraying it on. To get the paint ready for spraying, shake the can vigorously. Most manufacturers caution that stirring may cause the colors to blend. Those that do permit stirring advise you to stir *gently* and follow by boxing—pouring back and forth between two cans. Thinners, if required, will usually be either water or a special reducer that is supplied by the manufacturer. Using the wrong thinner or using too much may cause the colors to blend together.

These new paints will cover most surfaces with one coat. A primer, if required, can be either brushed, rolled or

paint must be sprayed on. Here are three guns that could be used.



INTERNAL-MIX SPRAYER. Best control is obtained with this type of gun used at low pressure and a large-opening nozzle. Overspray is a problem, making careful masking a must.

sprayed on, and should be allowed to dry thoroughly before proceeding.

As in any spraying, experiment at first by spraying on a piece of scrap cardboard or newspaper to determine the best speed at which the gun should be moved and to be sure that you have the paint at the right consistency. Hold the nozzle six to eight inches away from the surface, and move your arm so that the gun is always at right angles to, and at the same distance from, the surface. Varying the angle of application will also vary the color intensity and the pattern of the color flecks. Since two thin coats are better than one heavy coat, it is usually best to apply a light mist coat first. Allow this to set awhile and then go over it with a heavier finishing coat.

Most of these paints will dry to the touch in a little over one hour, and will be totally dry in three to four hours. However, they do not reach their maximum toughness for four to five days.

Do not attempt to spray the paint in unheated garages or other cold rooms. Make sure the room has adequate ventilation (open a window or two), and be sure to spread drop cloths or other coverings to protect the surrounding walls and floor. Use masking tape and



INSECTICIDE GUN. Try this for the smaller jobs, but use the continuous-flow, pump type, not the intermittent siphon kind. Enlarging the nozzle hole may improve the gun's efficiency.

newspaper to mask off those areas that are not to be painted, or to separate areas that are to receive a different color.

The new paint is safer to spray in confined areas than conventional paint; it does not atomize as finely and therefore creates no fine mist that is likely to settle on nearby walls, floors or furniture. But a hazard still exists.

Cleaning up. This should be tackled *immediately* after the job is done. If any masking tape has been used, remove it while the paint is still wet to get a clean sharp edge. Spraying equipment should be cleaned by first spraying a cupful of water through the nozzle and then rinsing in lacquer thinners. Spray some thinner through the gun to remove any specks of paint that may remain in the supply line or nozzle, and then wipe dry before storing. A pipe cleaner or piece of fine wire can be used to clean out the supply line or nozzle if any particles become lodged in the openings.

If you are ever forced to stop in the middle of a job, follow the same cleaning to keep the gun from clogging. **END**

Trade names and makers of one-coat spatter paints include: (Plexstone) Mas & Waldstein Co., 2121 McCarter Highway, Newark 4, N.J.; (Multakolor) United Lacquer Mfg. Corp., 1001 Elizabeth Ave., Linden, N.J.; (Vari-Krom) Vari-Krom, Inc., 639 First St., Itaboken, N.J.

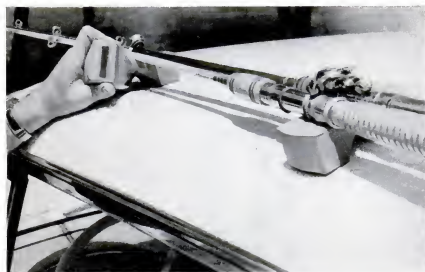
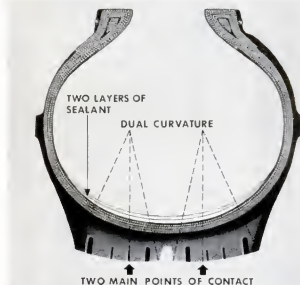
New for Your Car

1. New Battery Needs No Water. Intended for rough use, as in trucks, tractors and motorcycles, where acid spillage is a threat, this battery has a silicon electrolyte with the consistency of firm gelatin (visible in up-ended battery). Since the battery doesn't need water, it has built-in breather valves in place of filler caps. Guaranteed for four years, it costs \$34.95, in six- or 12-volt capacity.



2. Tire Has Dual Tread. A two-faced passenger-car tire that presents two surfaces to the road has been developed to give more traction, better maneuverability and longer wear. The groove down the middle of the tire distributes the weight on twin treads, each of which is curved on its own radius. Action is said to be like that of having two tires on one wheel. Puncture sealant is also twinned: two layers between three sheets of curved gum. The tire costs about \$100.

More information about these new car products can be obtained from: 1. Waterless Battery Co., 1234 N. LaBrea, Los Angeles 38; 2. General Tire & Rubber Co., Akron; 3. (carrier) Magnetic Products Corp., 13025 Halldale St., Gardena, Calif.; (pipe rack) Pipe Caddy Mfg. Co., Delray Beach, Fla.



3. Magnetic Holders Park Your Gear. Metal-hugging magnets in blocks of synthetic sponge rubber (left) anchor the tie-down cords of this car-top carrier for skis or fishing rods, without clamps or



cups. You can remove the blocks by rolling back the sponge. At right is a ring-type pipe holder for keeping your briar handy on a post or the dash. Twin magnets are in the base of the rubber ring.



Now they're making

Parquet Floors from Wood Scraps

By F. A. Strenge

YOU can turn inexpensive odds and ends of wood into beautiful parquet flooring. The trick? Invisible wood splines that lock the scraps into rigid blocks.

It's already been done at the U.S. Forest Products Laboratory in Madison, Wis. There, researchers have developed flooring blocks from leftover hardwood strips that can be bought cheaply from

SECRET OF THE PROCESS is your own home oven. Heat strips of wood so they shrink, insert them into grooved flooring scraps, and you have fine, permanently bonded parquet blocks.





NEW FLOOR FROM OLD SCRAPS began with this grooving jig at the Forest Products Laboratory. Scraps were locked together and two dovetail grooves cut on the underside with a router.



LONG SPLINES, heat-shrunk just before using, were then tapped snugly into the dovetail grooves. Splines were made thinner than the grooves so they wouldn't protrude after swelling.

lumberyards, furniture plants and other woodworking shops. The flooring was developed especially for concrete-slab houses, but can also be used over wood subfloors.

The idea is simple. You lay short strips side by side, cut a pair of parallel dovetail grooves across the back, and slip oven-dried splines of wood into the grooves. The dried, preshrunk splines start to swell at once and bind the strips into permanent blocks. No nails, glue or other fastening are needed.

You can use any kind of tough hardwood strips as long as they are of the same thickness and vary from 1" to 2" in width. Good flooring woods like oak, maple and birch are recommended, but you can also work in pieces of walnut, cherry, tupelo, gum, ash, elm and beech. By intermixing woods of different colors and grains, you can create striking patterns.

For the spline strips, soft pine is recommended because it has large shrinkage and swelling. A few fruit crates should provide all that you'll need.

Use dry lumber. Good flooring should

be fairly dry to keep it from shrinking in winter and opening up cracks. Unless the wood you buy is kiln-dried—and scrap-pile stuff isn't likely to be—it should be stored to dry it out before you use it.

Let the wood stand awhile in an unheated shed, crawl space or cellar. Then cut it into small pieces near the size you want and stack them, log-cabin style with vent spaces in between, for six to 12 weeks in a heated room.

The wood for the splines is dried in the kitchen oven just before you need it. Leave it in for 12 hours at about 200°. Cut the splines to final shape only after they're dry and then be ready to use them immediately.

Cutting the grooves. Clamp the flooring strips or lock them in a jig to hold them together while you groove them for the splines. A standard size for parquet blocks is 9" square, so cut the strips slightly longer than 9" before grooving, and then trim the completed blocks to exact size later.

The Forest Products people make two straight grooves first with a dado cutter in a table saw, then use a portable router



LOCKED TIGHT by the fast-swelling splines, a 3' strip of flooring could be removed from the jig almost immediately. Long strips were then cut into separate blocks on a table saw.



OFFICE NEEDED A NEW FLOOR so the Forest Products engineers tried out their own. Blocks were brushed with contact cement and set like tiles. They proved handsome and sturdy.

to shape them into dovetails. If a router isn't available, you can cut the whole dovetail on a table saw. Make two angled cuts $\frac{3}{8}$ " apart, sloping outward so that they are wider at the base than at the surface of the wood. Then clean out the wood between the cuts with a dado cutter.

Cut the splines to a similar dovetail shape, but make the sides slightly straighter than the angle of the dovetail grooves. This way the splines will have a little room to expand without crushing their edges. They should be a snug but not tight fit in the grooves.

When the strips are joined, wait a day for the splines to start swelling, then trim the blocks to final shape. With the saw at the same setting, run them through in both directions to make sure that all the blocks are square and uniform.

Laying them down. The parquet blocks are laid in the same way as conventional floor tiles, except that a contact cement is recommended in place of the usual black mastic. (Unless spread very thinly, the mastic may work up through

cracks in the wood strips and mar the surface.)

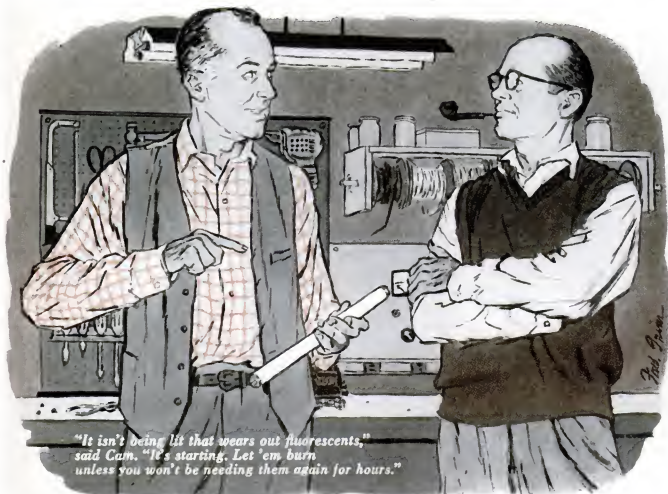
Use the rubber-base type of contact cement such as is sold for bonding kitchen counter tops. Brush it on both the floor and the backs of the blocks and let it set as the manufacturer recommends. This cement grips instantly, so lay the blocks carefully—you won't be able to slide them around once they're down. Tip them in place against adjoining blocks to keep them square.

You can use the cement on either concrete or plywood subfloors. On plank-type subfloors, it's best to face-nail the blocks in place to pull them down tight against the uneven boards. You can countersink the heads and cover them over with a matching-color wood filler so that they won't show. An occasional small hump in any kind of floor can be compensated for by chiseling out the underside of the block to fit over it.

When all the blocks are down, smooth them with a rotary floor sander, which you can probably rent from your hardware store. Then finish the floor with varnish, shellac or floor sealer. **END**

Cam Evans, electrical expert, tells what you should know about

Trouble-Shooting Fluorescent Lamps



By Jack Foster

CHILL gusts of wind nipped my heels as I started cleaning out my garage. The wintry sun had ducked behind a bank of bleak-looking clouds that promised snow.

In the back of the garage it was so dark that I had to switch on the new fluorescent light I had put up this summer. It flashed on, then winked out.

With a basketful of trash in both

hands, I peered at it expectantly. It obligingly blinked on. I started off with the basket. The light went out.

Putting down my load, I switched the light off and back on again. It lit. I picked up the basket.

The light went out.

Feeling like Donald Duck in a crisis, I carried out the basket. When I returned the lamp was lit. Then it went out.

Trekking next door I found Cam Evans working on a toy train under the

well-behaved fluorescents in his shop. "Promised my nephew I'd fix this before Christmas," he explained.

"Uh-huh. Cam, could you lend me a 40-watt fluorescent? I have a bad one."

He nodded. "Third shelf. Take a starter too, in case it's not the lamp."

I found both, thanked him and left. My garage light was still blinking. I put in the new lamp and starter.

It lit at the first flip. I loaded some old jugs into the basket—and the light went off. Then it repeated.

Finishing in semidarkness, I was taking out the last load when a scarecrow-like figure bounded into the doorway.

"Mr. Foster! Come see what I got."

It was Bud Nolan, even more excited than usual. When I got to the curb, Cam was standing by the boy's topless jalopy. It was loaded with what looked like junk.

"Look at 'em! Ten perfectly good fluorescent lights. Mr. Nichols is remodeling his store on Main Street. He gave me all these for cleaning out the place."

Cam lifted a couple. "Good deal, Bud, they're a little old, but useful."

"I'll say. That crusty Mike Willard in the shoe store saw me carry these out. He asked Mr. Nichols to sell him one, but Mr. Nichols said it was up to me."

Bud chuckled. "Old Willard didn't like it, but I sold him one—for five bucks."

Cam said, "Take them into my shop. I'll show you how to check 'em. Clean them good—dirty fixtures can lose a lot more light than you'd think."

We helped Bud take his haul downstairs. Cam cleared a bench for him. "Now, Jack," said Cam. "What's wrong?"

"Fluorescent lamps," I answered. "They're too hard to figure out. When an incandescent bulb quits, you know it and replace it. But fluorescents blink and flicker or get dark spots or burn out—"

"Whoa. You put the first one in your kitchen a year ago, and three or four more this spring. Odds are you won't burn one out for four years."

"Four—years?"

Cam nodded. "Today's fluorescent

Chart for diagnosing fluorescent-lamp ailments

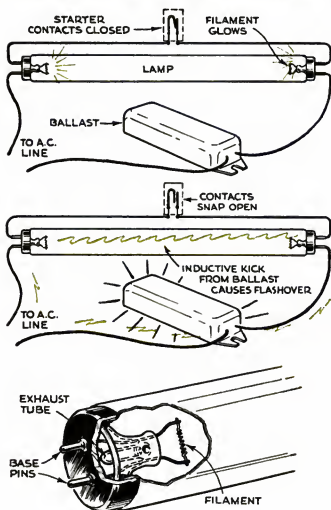
| SYMPTOM | POSSIBLE CAUSE | REMEDY |
|---|--|---|
| Blinking on and off | Lamp at normal end of life | Replace lamp |
| | Defective starter | Replace starter |
| | Low temperature or cold drafts | Substitute thermal starter, shield lamp, or use low-temperature lamp |
| | Wrong ballast | Check rating |
| | Low line voltage | Check voltage |
| Ends continue glowing when lamp is lit | Poor contact in lamp holders | Make sure holders are firmly mounted, wires tight and lamp pins clean |
| | Short circuit in starter condenser | Clip out condenser or replace starter |
| | Starter contacts welded together | Replace starter |
| | | |
| Lamp will not start or starts reluctantly | No current | Check outlet |
| | Bad on-off switch | Replace switch |
| | Broken filament or air leak | Check filaments; replace lamp if necessary |
| | Starter sluggish or at end of its life | Replace starter |
| | Wrong ballast or open circuit in it | Check ballast |
| | Burned-out filaments | Inspect for broken lamp holder, grounded socket or wiring before replacing lamp |
| | Low line voltage | Check voltage |
| | Open circuit | Test voltage across lamp holders, leads to them, and circuit |
| Pronounced irregular flashing or flicker | Temporary defect in new lamp | Turn lamp on and off several times |
| | Starter defective | Replace starter |
| | Wrong ballast | Check rating |
| | Temporary defect in used lamp | Turn lamp off briefly |
| | Defective lamp | Try another in same holders |
| Reduced light from lamp | Light output of new lamp is above rating | Lamps normally give less light after first 100 hours |
| | Cold drafts or low temperature | Shield lamp or enclose it |
| | Too much heat around lamp | Ventilate fixture |
| | Low line voltage | Check voltage |

lamps have an average life of 7,000 hours. If you burn 'em three hours a day, half of them should last seven years. I said four to be conservative."

"Huh! I nurse them—turn them off every time I walk out of the room."

"In that case," Cam said quickly, "I'll

How a fluorescent lamp works



IT'S GAS THAT GLOWS in a fluorescent lamp. Electrons flowing through mercury vapor cause it to emit ultraviolet radiation. Chemicals inside the glass tube (phosphors) convert the ultraviolet into visible light.

The phosphor-coated tube has inside it a little argon or krypton gas, a drop of mercury, and a filament at each end. Connected through a starter switch and a ballast—an iron-cored wire coil that holds current to safe limits—the filaments glow, emitting electrons (top). As the starter automatically opens, the ballast generates a high-voltage kick that makes electrons flash over, lighting the tube, and the filaments no longer glow. A manual starting switch can be used. These are common in desk lamps.

cut the four years to two. The less often you turn them on and off, the better—it's starting that wears them out."

"Costs juice to let them burn."

"You're still ahead. A 30-watt lamp and ballast take about 35 watts, but gives more light than a 100-watt bulb. It outlasts so many bulbs that you save on replacements too."

Bud shuffled his feet. "Mr. Evans, would you mind looking?"

He showed us a fixture lying on the bench. One lamp was lit. The other blinked on and off, shimmering oddly.

"That lamp is worn out," said Cam. "See how the ends are blackened for a couple of inches, and glow red between blinks? The filaments have lost their coating and can't emit enough electrons to establish the arc, Bud."

"But the fixture is okay, huh?" Bud sighed in relief. "How about this one?"

The lamp he switched on did nothing.

"Contacts may be dirty. Try twisting the lamp in them," Cam suggested.

Bud did so, but the lamp stayed dead.

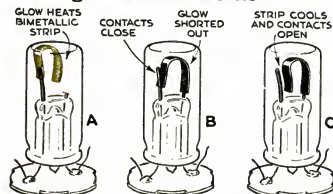
"Could be a bad filament or a broken lamp-holder connection," said Cam.

Bud removed the lamp. "Can I use this to check?" He picked up a test bulb—a socket with two wires attached.

Cam shook his head. "That 40-watt fixture has an autotransformer in the ballast to boost voltage to 200. It would burn out the bulb. You could use a 220-volt bulb, a neon tester, or a voltmeter."

Bud held the prods of the neon tester Cam gave him to one contact in each holder. It showed nothing. He changed prods to the other clips with no result.

How a glow starter works



COMMON GLOW-SWITCH STARTERS consist of a small glass bulb filled with neon or argon gas. With the fluorescent lamp unlit, there is enough voltage across the fixed starter contact and the bimetallic strip to cause a glow discharge (A). This heats the strip, making it bend and touch the other contact, which closes the filament circuits in the fluorescent lamp but shorts out the current that causes the starter glow (B). The strip therefore cools and snaps back, opening the contacts and making the ballast create a voltage surge that starts the lamp (C). With current flowing in the lamp, there is not enough voltage to cause a glow in the starter, and it stays open until the lamp is turned off.

"Ballast's burned out," he groaned.
 "Keep checking. Remember, only one clip in each holder should be alive. That means you can check across them four ways, and only one should show juice."

Bud shifted just one prod. The neon bulb stayed dead. He switched the other, and the indicator glowed.

"It's the lamp after all," he said.

"Let's have a look," Cam suggested.

Punching a small hole in a piece of aluminum foil, he shaped the foil over a big incandescent bulb. As he held the fluorescent lamp over the hole, a Y-shaped shadow appeared on the tube. The fragments of a filament dangled from its horns.

"Let's try a different check on this one," Cam said, picking up a lamp that had two bent base pins. He inserted them with difficulty into a holder connected to a screw socket with a 60-watt bulb in it. A pink-violet glow appeared.

"*This lamp's been dropped.* It has an air leak. Better dump it, Bud."

"Okay, I will. Here's another I guess is no good. The ends keep glowing."

"Put in this starter," said Cam.

He gave Bud a starter shell with two wires and a snap switch. As Bud inserted it, the lamp lit, the ends glowing yellow.

"Flip the switch," Cam ordered.

As Bud did so, the end glow winked out, while the lamp remained lit.

"Starter was defective," Cam said.

"Now let's see about your trouble, Jack."

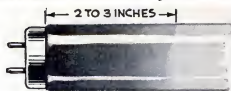
We walked to my garage. As I turned on the lamp it flickered just as before.

"It worked fine when I put it up this fall," I said. "Now look at it."

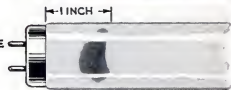
"It's the weather," said Cam soberly.

Lamp spots and what they mean

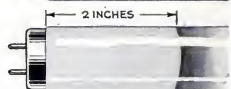
A
 NORMAL AGING;
 LAMP NEAR END
 OF ITS LIFE



B
 NORMAL IN OLD
 LAMPS; EXCESSIVE
 STARTING OR
 VOLTAGE IN
 NEWER ONES



C
 RING OR BAND
 HAS NO
 SIGNIFICANCE



D
 STREAKS ARE
 CONDENSED
 MERCURY



LAMP DARKENING may be a symptom of circuit trouble. If normal end blackening (A) appears too early, the starter may be bad, the ballast the wrong rating, line voltage excessive or the lamp loose in its clips. Similar faults may lead to dark spots (B); but if there is no circuit fault, spots may disappear in time. Gray-brown rings or bands (C) can be ignored as a small appearance defect. Streaks of condensed mercury (D), usually along the bottom, may be due to cold drafts or cool metal touching the glass. These streaks are harmless (turning the lamp 180 degrees may help eliminate them).

I glared at him. "Joke, huh?"

"No joke, Jack. Fluorescents are hard to start when they get chilled. Line voltage may be a bit low out here, too."

"The tube you gave me lit at first."

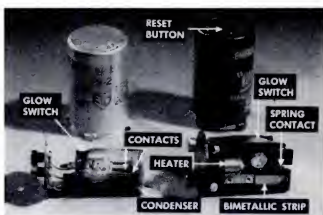
"Sure. It was still warm from being in my basement." Cam snapped out the starter. "Is this the one from my place?"

"Yeah. You said to take it—"

"Uh-huh. But you took a 20-watter. It

.....

WITH THEIR COATS OFF, two popular types of starters—the glow switch (near right) described on opposite page, and the manual reset (far right)—look like this. The small condenser is chiefly to reduce radio interference. If it shorts, it may be snipped off to make the starter serviceable again. Manual reset has a heater coil besides. If lamp does not light after several flashings, coil develops enough heat to trip bimetallic contact, opening circuit. When lamp is replaced, starter must be reset by pressing a button. Thermal-switch starters (not shown) have a heater that warms up a bimetallic strip until it opens, starting lamp. Heater stays warm, drawing a tiny current, while the lamp is lit.



Two ways to check condition of fluorescent-lamp filaments



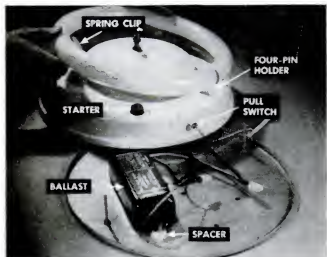
MOUNT A LAMP HOLDER and a screw socket in series like this. Insert 25-watt bulb for testing 4 to 13-watt fluorescents, a 60-watt for 14 to 40 watters, a 200-watt for 90 and 100-watt lamps. Shield bulb to see glow at end of lamp; it should fluoresce, indicating filament is emitting electrons. Red glow means that the filament coating is exhausted (also shown by end darkening) or that the lamp has an air leak.



YOU CAN SEE if the filament is intact with this simple setup. Cover any 100-watt bulb with aluminum foil in which a good-sized pinhole has been punched. Turn on the bulb and hold suspect fluorescent lamp before the pinhole. Shadow of filament and its supports will be thrown on the inner surface of the tube as shown above. Do not confuse solid supports with the coiled filament between them.



TO MAKE A TEST STARTER, open an old one, unsolder and discard inner parts, and solder lamp-cord leads to base terminals. Run cord out through hole punched in shell, and reassemble. Attach snap switch to other end of cord.



CIRCULAR LAMPS have a single four-pin plug. Always push the pins into their socket first; then lower the lamp into the spring clip as above. In this fixture, the ballast is mounted on soft asbestos spacers to minimize hum.

would keep a 40-watt lamp like this blinking even if it weren't cold."

"Heck, I thought all starters were alike. I better put back a bulb socket here."

"You needn't. Try a thermal starter, and rig something to keep drafts off the lamp. If that doesn't help, you can get a low-temperature lamp in this 40-watt size. Worth it, too. Fluorescents are ideal to work by."

"Then I need 'em—or bifocals," I said. "When I turned on my lathe last night for the first time since spring, it seemed to be running backwards at times."

What Cam meant to answer was forgotten as a car screeched to a stop outside. A small, red-faced man carrying a two-lamp fluorescent fixture stomped angrily into Cam's shop.

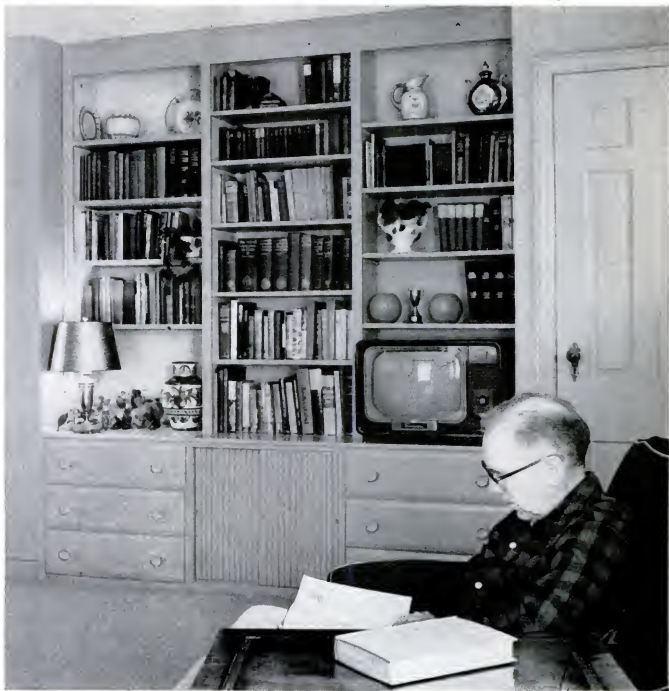
"No young smart aleck is going to take me," Mike Willard roared as we followed.

[Continued on page 230]

NEXT MONTH:

For the home electrician: New switches and outlets modernize home wiring. Read how to install them with just one tool—a screwdriver.

It's Worth Remembering:



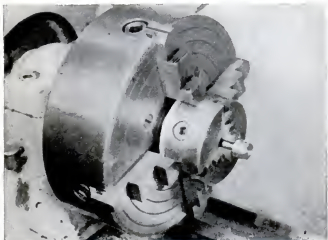
Ready-Made Units Make Built-in an Easier Job

BUILDING drawers may be an easy job for a skilled woodworker, but I'm not a skilled woodworker. For this built-in, in a wall recess in my home, I avoided the issue by buying three unpainted cabinets of the same height—two with drawers, one with sliding doors. A wood filler strip took care of a slight gap at each end of the line of cabinets.

Filler strips also were placed at the rear, level with the tops of the cabinets, to bring the fronts flush with the wall line.

For a continuous top surface I puttied the joints and sanded them smooth. Molding hides the front joints. The shelves and uprights above are $\frac{3}{4}$ " lumber. The shelves rest on cleats.—Howard G. McEntee, Ridgewood, N.J.

New Shop Ideas



Dual Chucks Center Small Work. When a big lathe is fitted only with a four-jaw independent chuck, or its own large three-jaw will not close far enough for small work, it can be set up as above.

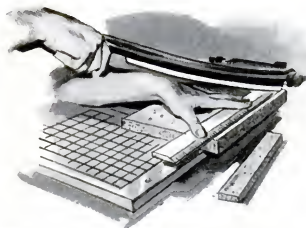
Mount a small universal chuck in the four-jaw, with its key socket between two jaws. Insert a piece of round stock in the little chuck and set a dial indicator on it. Then adjust the jaws of the independent chuck so that the stock runs true.—*H. J. Gerber, Stillwater, Okla.*



Aligning Cemented Sheets. In using contact cement, you must be careful to keep the coated surfaces from touching until exactly aligned. Directions usually advise inserting paper between, but sliding this out may move the sheet.

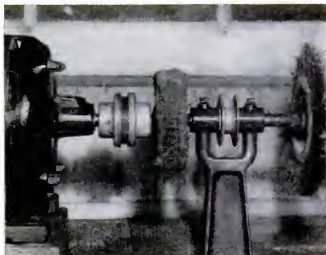
Strips of wood about $\frac{1}{4}$ " square serve the purpose better. Place them close enough to prevent sagging. With the sheet in position, pull out one strip of wood at a time as you press it down.—*Warner G. Tilsher, San Gabriel, Calif.*

HAVE YOU TRIED THIS?



Slicing Foam Rubber. Difficult to cut neatly with knife or shears, foam rubber can be sliced evenly to any thickness on a trimming board as shown above. Squeeze the rubber down with a ruler as you lower the knife to cut.

Beltless Drive Saves Room. Lack of space sometimes makes it impossible to mount a motor behind a power tool in the usual way. But tools that may be run at the speed of the motor, such as polishing heads, can be direct-coupled as shown below. Block up the tool or the motor if necessary to align the two shafts, and join them with a flexible coupling.—*Herbert Y. Moon, Orient, N. Y.*



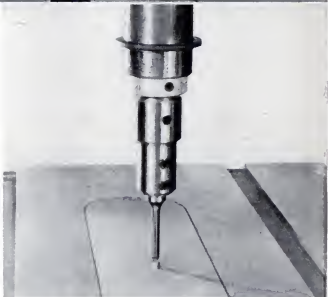


Carving the Easy Way. Trays, steak platters, box lids and trim with routed ornamentation can be turned out on the drill press. By using a pattern to guide the work, you can make any number of pieces, all exactly alike.

Place a blank insert in the drill-press table if it is the type shown, or screw a false top of $\frac{3}{4}$ " plywood to the table. Chuck a drill the size of the router bit to make a hole in the insert (in a wooden top, use the router bit itself). Drive a tight-fitting steel pin or hardwood dowel into the hole until only $\frac{3}{16}$ " protrudes.

Mark the pattern design on $\frac{3}{4}$ " plywood or hardboard. Cut out the recess areas and smooth all edges. You can trace this cutout design on top of the stock as a help in guiding, but this is not necessary after you've done a few pieces. Fasten the pattern to the underside of the stock with brads or short screws.

Holding the work firmly down on the table, with a pattern recess area over the pin, move as the pin permits. Raise the spindle to move to the next area. When all parts are recessed, remove the pattern and attach it to the next piece of stock.—*Darrell Huff, Sonoma, Calif.*



DRILL A HOLE for the guide pin with table locked, so that pin is centered below spindle.



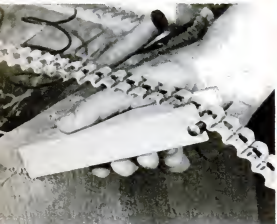
TACKED TO BOTTOM of stock, pattern is placed over pin that guides the work as it is routed.



Skidproofing a Level. Held with one hand against a smooth wall surface, a level will tend to slip out of position as you try to mark along it. To help it stay put, fold a piece of sandpaper with the grit out. Place this between the level and the surface as shown at left.



1 WHERE SPRINGS meet seat, retie any free loops of twine. Leave opposite (bottom) ends of springs loose.



2 SPECIAL STRETCHER pulls new webbing taut. It consists of notched wood block. A nail rests in the notch.



3 NAIL WEBBING to frame, push springs aside, stretch and nail to other side, break off. Align with spring centers.

208 POPULAR SCIENCE

New Seat Webbing Makes Repairs Easier

IT'S the breakdown of webbing, not coil springs, that causes most sagging seats in upholstered furniture. A new steel webbing tape* available in kit form now makes such repairs easier.

The tape has built-in loops that lock spring ends in position and thus eliminate bottom twine-tying. Each kit includes a stretcher tool and special hardened nails for driving through the metal to fasten the tape to the frame.

To reweb a chair, remove the muslin dust cover and cut away the jute webbing. Pry out as many tacks as possible, sink those that won't come free. Remaining steps are shown in the photos.

*Available from Neversag Products, Inc., 901 E. 135th St., New York, N.Y. About \$1.69 for a chair size kit, \$4.59 for the sofa size.



4 PRESS THE SPRINGS BACK under the tape after the tape has been crisscrossed on the frame. Twist each spring as above to lock its free end in a webbing loop. Replace the dust cover and the seat is ready for use again.



DRIVE
NUT



PUNCH



PUNCHED
STOCK



DIE

DRIVE SCREW

You Should Try Chassis Punches

By Kenneth Murray

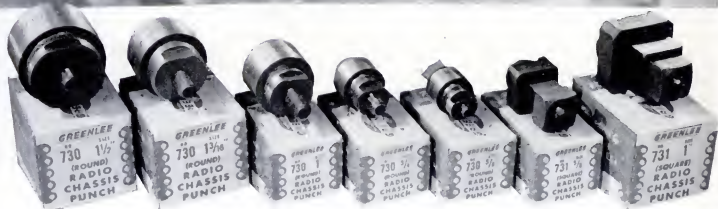
RADIO workers have squirreled away a set of tools that the rest of us could use in scores of everyday jobs. They call them chassis punches.

What are they? Chassis punches are pocket-size punch presses. A couple of twists of a wrench and one of these tools will drive a hole through mild sheet steel as easily as a cookie cutter shears through dough. Radio workers use them to cut openings in chassis metal for tube sockets, filter condensers, transformers, meters and other components.

Each punch cuts a hole of a particular size and shape. Round ones range from $\frac{1}{2}$ " to $3\frac{1}{4}$ "; square ones from $\frac{3}{8}$ " to 1".

Cork, fiber, asbestos, brass, copper, lead, thin laminates—you name the material and it's a quick bite for the chassis

POCKET-SIZE BUT TOUGH, chassis punches like these make light work of driving clean-edged holes through flat stock. They come in a wide range of sizes.



Don't Cut It: Punch It

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punch. Among the few exceptions are some plastics, the kind that make a brittle sound when you snap them with a finger. Even with heat applied to both the material and the punch—usually an effective treatment—a dense, hard plastic may shatter under cutting pressure. When in doubt, always make a test punch in a piece of scrap to find out how the material will react.

How do you use them? Drill a pilot hole, the same diameter as the punch's drive screw, through the stock. Place the punch on one side and the mating die on the other. Slip the drive screw through the hole in the die and on through the pilot hole. Thread the screw into the punch or, if your make of punch has a drive nut, slip the punch over the drive screw and then thread on the drive nut. Either way, a few turns of a wrench on the screw will draw the punch smoothly through the stock.

Where do you buy them? You'll find a selection of these punches in any radio-supply store or mail-order catalogue. They cost around \$15 a set.

Where can you use them? For just about any hole-making job that you encounter in sheet metal, plastic and other flat stock. For instance, they'll drive precision-size holes through tileboard or plastic panels for electric and plumbing fixtures. They're made to order for punching out ornamental grilles, cardboard stencils or lettering guides. Want to fabricate some "structural steel" members for a toy or model? There's nothing simpler. Make a series of punches, round or square, in a strip of heavy-gauge aluminum. Use oil to ease the cutting.

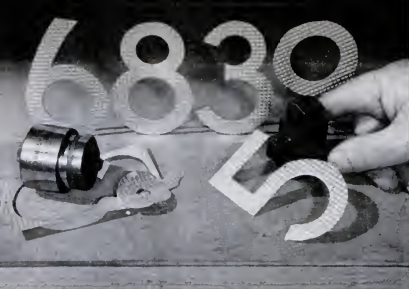
Size and shape don't limit chassis-punch usefulness. By using a square punch repetitively, you can cut out large square or rectangular holes piecemeal. Likewise, round punches solve the problem when openings with curved edges are required.



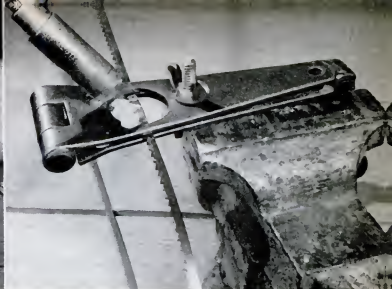
REPETITIVE PUNCHING makes attractive grilles. Pilot holes are first drilled to take the drive screw. Turning a nut on the screw draws the punch through the metal and into the die.

CUTTING HOLES IN GASKETS is a cinch. If you use soft leather or rubber, wet the material liberally with wood alcohol just before punching. But cut cork, fiber or asbestos dry.





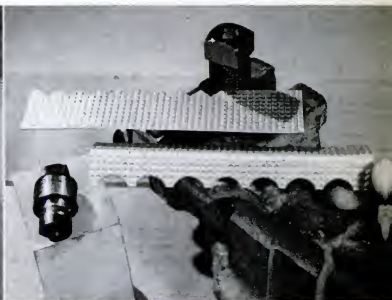
HOUSE NUMBERS are easy to make, using tin snips for the outside cuts, round or square punches for the tricky inside cuts. Waffle-pattern aluminum makes numbers highly reflective.



HANDY JIG for brazing bandsaw blades is made by punching holes in a strap hinge, and using a bolt and wing nut to apply clamp pressure. Punches will go through 3/32" mild steel.



BRACKETS for pliers, files and other small tools can be turned out neatly and speedily. After punching the holes, bend the metal strips to grip shelving or a workbench backboard.



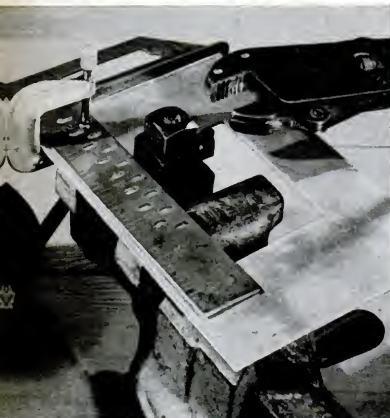
CUSTOMIZED METAL TRIM and moldings for sinks, tables and counters can be "nibbled" into shape with either round or square punches. Holes cut in strips can also dress them up.

SPOTTING ELECTRIC-OUTLET HOLES in stainless steel or plastic tile is a round-punch job. Always apply light machine oil to the screw and cutting edges to ease job when punching metal.

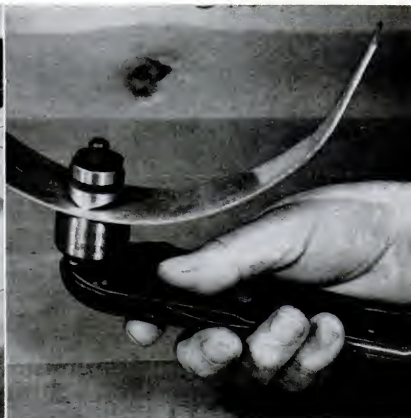


INSIDE-OUTSIDE CALIPER is made from heavy-gauge brass ring, cut with two punches. Halve ring; round ends with a file. A short bolt and wing nut form the hinge. *(Please turn page)*

These Kinks Make Chassis Punches Versatile.....



SETUP TO PUNCH LARGE SQUARES or rectangles with a small square punch: Clamp a straight-edge to the stock for a guide; then make as many progressive punches as necessary.



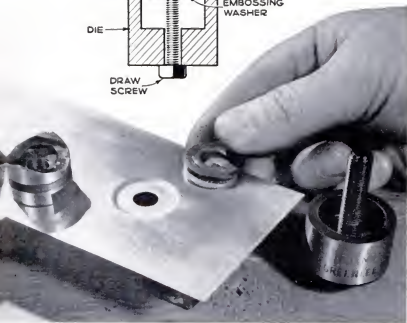
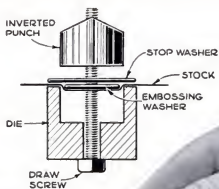
TO PUNCH CURVED METAL, place the die on the outside of the curve. Hold the cutting points of the punch in the trough of the curve until the drive screw sinks them in the metal.

"STRIPPER" SAVES TIME, when punching multiple holes by the drive-screw method. Here, a rubber pad pushes the waste material out of the die as the punch pressure is relieved.

WHEN SHARPENING PUNCHES, limit grinding to the faces of the punch and die. This is a "position" picture; a nut-anchored bolt should be used as a handle when grinding the surfaces.

FOR THICK-PLASTIC PUNCHING, apply heat to both the material and the punch. Just as the plastic starts to "wilt," grip the punch in a vise and then turn the drive screw gently.





EMBOSSING or plate-sinking sheet metal is simple. Place the die below the work, and a washer the size of the area to be depressed above the stock. Use a larger washer as a stop.

TO ENLARGE A HOLE with a punch, insert a snug-fitting washer, or the waste stock removed when cutting the original hole. Slip the drive screw through the hole in the washer and the new cut will be accurately centered. You can use this trick to cut washers, too.



MULTIPLE PUNCHING SETUP for thin metal: Chuck the punch in a drill press and center the die below it. Moderate pressure on the feed handle forces the punch through thin sheet metal. **END**

How to Choose the Right Pickup

Getting music off a record takes a tiny electric generator built with watchmaker's care. Here's what's in a good one.

**By Hubert Luckett
and Martin Mann**

JUST about the most precise piece of machinery you can buy in a store is, of all things, a phonograph record. For just a couple of bucks you get millionth-of-an-inch accuracy, gift-wrapped. The pickup cartridge that converts this microscopic statue of music into pulsing sound has to be as good.

We examined—and played—13 hi-fi pickups. Their prices go up from about \$5 to \$90, and performance goes up, too, but not necessarily the same way.

You start with a mechanical, solid record: a plastic disk engraved with a V-shaped groove, a wiggling spiral scratch that is typically .0025 inch wide, with a tolerance of plus .0005 inch and minus zero. How much the groove swings sideways for a given tone determines loudness. But the biggest oscillation can be .0009 inch; that picayune range must encompass everything from dead silence to the Philharmonic on a flat-out fortissimo—without unwanted movement held below .000006 inch.

The reproducing needle—stylus—must follow each microscopic oscillation faithfully without wearing down the plastic. It must wave back and forth 15,000 times per second just as easily as it does 30 times a second. As it waves it must gen-

erate electricity (which the loudspeaker converts into sound). For loud notes—wide swings of the stylus—the voltage must be greater than for soft notes. But the voltage must be the same for high pitches—rapid swings—as for low pitches.

How to tell a good one. Pickup engineers aim for the same general goals. The goals are unattainable and every design is a compromise. Any engineer will make your head spin faster than 33 $\frac{1}{3}$ r.p.m. as he explains why *his* compromise is best.

Knowing what's involved will help you make a choice yourself. The chart on pages 216-17 lists specifications, furnished by the manufacturers, for the 13 hi-fi pickups that PS examined and a few that we didn't.

Frequency response. The "kilocycle boys," as one engineer caustically calls them, judge a pickup solely by the range of tones—lowest to highest—that it can handle. What's just as important is *how* the range is reproduced.

Two clues to the quality of the high and low tones you'll get from a pickup are its dynamic mass and lateral compliance. This is hi-fi jargon for the inertia and flexibility of the stylus assembly.

Dynamic mass. You want the stylus and the parts that move with it to have little inertia. Imagine trying to shake a brick back and forth very quickly. Not

Second of a series on shopping for hi-fi components. Next month: Tone arms.





easy. But you can shake a table-tennis ball quite fast. The stylus assembly should be like the table-tennis ball, with a dynamic mass low enough to make the rapid changes in direction that high-frequency notes call for. Otherwise those tones blur, sound "dirty."

Compliance. For low-pitched tones, and high amplitudes, it is ease of bending sideways that counts. A compliant pickup lets the stylus follow wide swings of the record groove.

Compliance in the vertical direction

NOVEMBER 1956 215



FAIRCHILD



ESL CONCERT



SONOTONE



ELECTRO-VOICE



ASTATIC



PICKERING



RONETTE



MIRATWIN



GENERAL ELECTRIC

is also necessary, to allow the stylus to ease over an uneven record surface and to ride up in a pinched record groove.

What you don't want. As the stylus bears against the record grooves, it wears them, too. To protect your investment in music, its touch should be as light as possible. Low dynamic mass and high lateral compliance benefit here.

A stylus that is easy to move at all frequencies won't beat up the grooves. Also, it doesn't need to be pushed down so hard to hold it solidly against the groove walls—engineers say it needs little vertical tracking force. This is simply the weight that the pickup puts on the record. With a good pickup in a good tone arm, the force is six grams ($\frac{1}{8}$ ounce) or less. Slightly more force is needed if

the pickup is used with an automatic record changer.

Resonance. This is one of the things that you especially don't want in a pickup: sympathetic vibration of the stylus. It happens because the pickup, tone arm and plastic record are a combination of weights with springy materials. And a spring-held weight will oscillate violently if you shake it at just the proper rate.

Low-pitched music on the record shakes the stylus at a slow rate. The stylus support acts like a spring and the tone arm serves as a weight. At a particular low pitch, the arm and stylus together shimmy the way front wheels of some cars do at a particular speed. The sound comes out loud and awful, and the vibration hammers at the record



| MANUFACTURER | MODEL & PRICE | TYPE | STYLUS ^a | | | FREQUENCY RESPONSE (cycles) | OUTPUT VOLTAGE (millivolts) | |
|----------------------------------|--|--------------|---------------------|----------|---------------------------------|--------------------------------|--------------------------------|--|
| | | | MICRO-GROOVE | STANDARD | CAN STYLUS BE REPLACED BY USER? | | | |
| GENERAL ELECTRIC | RPX-052A Variable Reluctance \$23.37 | moving iron | D | S | yes | 30-15,000 ± 3 db | 12.7 | |
| ELECTROSONIC LAB. | Soloist \$29.95 | moving coil | D | — | no | 18-16,000 ± 1 db | 1.0 | |
| | Concert \$35.95 | moving coil | D | — | no | 18-20,000 ± 0.5 db | 0.6 | |
| | Professional \$49.95 | moving coil | D | — | no | 18-20,000 ± 0.25 db | 1.2 | |
| BANG & OLUFSON FOR FENTON CO. | Fen-Tone B & O 350A Std. \$24.20 | moving iron | D | S | yes | 20-16,000 ± 2 db | 50 | |
| | Fen-Tone B & O A Special \$24.20 | moving iron | D | — | yes | 20-16,000 ± 2 db | 50 or 22 | |
| PICKERING | Fluxvalve \$49.50 | moving iron | D | S | yes | 20-20,000 ± 2 db | 25 | |
| FAIRCHILD | Micradjust 225 \$37.50 | moving coil | D | — | no | 20-20,000 ± 2 db | 5.6 | |
| AUDAK | Audax Hi Q7 \$47.70 | moving iron | D | S | yes | 15-14,000 ± 2.5 db | 32 | |
| BRITISH INDUSTRIES | Leak Dynamic \$59.00 ^d | moving coil | D | — | no | 40-20,000 ± 1 db | 56 | |
| AUDIOGERSH | Miratwin \$45.00 | moving iron | D | S | yes | 20-18,500 ± 2 db | 35 | |
| WEATHERS INDUSTRIES | Weathers FM Pickup \$89.20 ^d | FM modulator | D | — | yes | 20-20,000 ± 1 db | 600 200 | |
| RONETTE ACOUSTICAL | 284P \$5.40 | crystal | S | S | yes | 30-12,000 | 300 | |
| | 284PX \$7.00 | crystal | S | S | yes | 30-15,000 | 300 | |
| | 284 O.V. \$4.50 | crystal | S | S | yes | 30-11,000 | 500 | |
| ASTATIC | 55-TJ \$9.50 | ceramic | S | S | yes | 30-10,000 ± 3 db | 980 | |
| | 312-TB \$9.00 | crystal | S | S | yes | 30-10,000 ± 2 db | 1,120 | |
| SHURE BROS. | Music Lovers \$38.95 | ceramic | D | S | yes | 30-10,000 ± 3 db | 400 | |
| ELECTRO-VOICE | 84 D Ultra-Linear \$23.10 | ceramic | D | S | yes | 20-15,000 ± 2.5 db | 500 | |
| SONOTONE | 3 T \$32.50 | ceramic | D | S | yes | 20-15,000 ± 1.5 db | 540 | |

NOTES: ^aD means diamond stylus—S, sapphire

^bThese manufacturers state that vertical output is negligible; all figures in this column are approximate

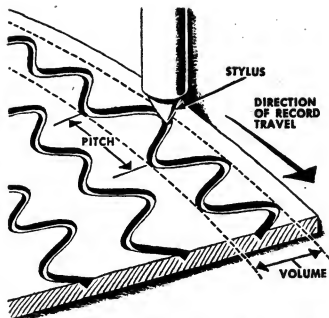
^cCannot be used with a record changer

^dPrice covers cartridge and tone arm, which must be used together

grooves. At pitches somewhat below resonance, the stylus and tone arm move as a unit; there is no motion of the stylus relative to the pickup—and no sound. So the pickup cannot reproduce pitches much below low-frequency resonance.

High-pitched notes shake the stylus rapidly. Now the stylus itself acts like a weight and the plastic record material gives enough to be a spring. You get a high-frequency resonance.

Short of repealing the laws of physics, there's no way of eliminating these resonances entirely. They can be made less objectionable, however. There are three common fixes: (1) Make the stylus so compliant that its low-frequency resonance occurs at a pitch too low to be on a record—below the audible range, (2)



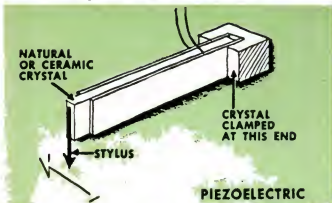
MUSIC ON A RECORD is a swinging groove that pickup stylus must follow exactly. Spacing of swings determines pitch. Width of swings—at a given pitch—determines the loudness.

| VERTICAL TRACKING FORCE (grams) | | COMPLIANCE (millionths of a centimeter per dyne) | | RESONANCE (cycles) | | LOAD RESISTOR (ohms) | INTERNAL INDUCTANCE (millihenries) | INTERNAL RESISTANCE (ohms) | DYNAMIC MASS (milligrams) | RATIO OF LATERAL TO VERTICAL OUTPUT | MAGNETIC ATTRACTION (grams) |
|------------------------------------|----------------------|---|----------------------|-------------------------------|---------------------------|--|---------------------------------------|-------------------------------|------------------------------|-------------------------------------|--------------------------------|
| | | | | | | | | | | | |
| arm | changer | lateral | vertical | high | low | | | | | | |
| 6 | 7 | 1.2 | 0.3 | 11,000 | 16 | 6,200 | 520 | 375 | 8 | b | none |
| 3 2-3 1-3 | 6 5 e | 5 6.8 6.8 | 0.5 0.7 n.s. | n.s. over 20,000 20,000 | below 20 below 15 9 | non-critical non-critical non-critical | n.s. n.s. n.s. | 1.5 1.5-2 1.5-2 | 2 1 1 | b b b | .5 .5 .75 |
| 5-9 3-9 | 5-9 5-9 | 5 5 | n.s. n.s. | 22,000 22,000 | n.s. n.s. | 100,000 100,000 | n.s. n.s. | 350 350 or 50 | 3.5 3.0 | n.s. n.s. | n.s. n.s. |
| 3-4 | 5 | 3-5 | n.s. | 25,000 | below 20 | 25,000 | 250 | 850 | 0.5 | n.s. | n.s. |
| 6 | 6 | 2 | 2 | 17,000 | 9-10 | over 5,000 | 2 | 195 | 2.5 | b | .5 |
| 6 | 7.5 | 5.3 | 3.5 | 13,500 | below 30 | 100,000 | 650 | 475 | 2.6 | 1,800/1 | none |
| 2-3 | e | n.s. | n.s. | 21,000 | 20 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 6-7 | 7-8 | 5.1 | 2.2 | 18,000 | n.s. | 47,000 | 385 | 1,400 | 3.1 | 15/1 | .5 |
| 1-1.5 | e | 14 | 12 | 23,000 | 15 | 100,000 | e | e | 0.5 | b | none |
| 2-6 2-6 4-6 | 6-10 6-10 6-10 | 3.0 3.0 2.3 | n.s. n.s. n.s. | n.s. n.s. n.s. | n.s. n.s. n.s. | 1,000,000 1,000,000 500,000 | e e e | e e e | 8.0 8.0 n.s. | 18/1 18/1 12/1 | none none none |
| 10 6-9 | 10 6-9 | 1.0 2.0 | n.s. n.s. | n.s. n.s. | 24 18 | 2,000,000 2,000,000 | e e | e e | n.s. 8.0 | 10/1 18/1 | none none |
| 5 | 7-8 | 1.5 | 0.5 | n.s. | 20-35 | 3,000,000 | e | e | 7.5 | 10/1 | none |
| 4-6 | 6-8 | 3.0 | 0.7 | 15,000 | 20 | 3,000,000 | e | e | 2 | 30/1 | none |
| 4-6 | 6-8 | 2.0 | n.s. | n.s. | 15 | 3,300,000 | e | e | 6-8 | n.s. | none |

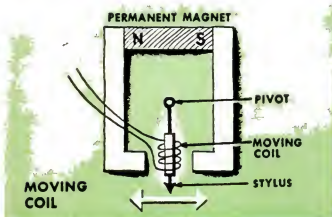
*This information does not apply to these cartridges

n.s. Not specified by the manufacturer

Four ways to generate electricity with a swinging stylus



FLEXING SOME CRYSTALS makes them generate electricity. Their high output voltage needs no preamplification. Many piezoelectric pickups now use synthetic crystals of barium titanate ceramic, which are less affected by temperature and humidity than natural crystals.



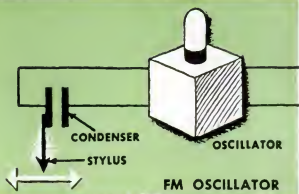
MINIATURE ELECTRIC GENERATOR, identical in principle to big power-plant generators, forms moving-coil pickup. The stylus moves a tiny coil of wire so that it cuts across the magnetic field produced by a permanent magnet. This induces a current in the moving coil.

make the dynamic mass of the stylus so small that its high-frequency resonance occurs at a pitch too high to be on a record, (3) restrain the stylus with viscous damping material.

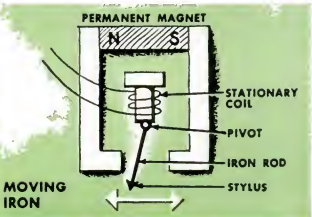
This last fix must be used sparingly. Damping makes the stylus stiffer at high frequencies; then it can't follow the commands of the record groove so easily.

Vertical response is something else you don't want in a pickup. The music is recorded as lateral oscillations of the groove only. Any vertical motion of the stylus is caused by record imperfections, slight variations in groove width, or turntable rumble. The pickup should ignore those movements.

How it fits. The pickup has to work with the rest of a hi-fi rig. So which one



THIS ONE IS LIKE TINY FM RADIO STATION. Cartridge acts like condenser, with stylus attached to one movable plate. Vibration of stylus varies capacitance, modulating an FM oscillator. Only FM pickup is the Weathers, expensive and delicate, but a very fine performer.



MOVING-IRON TYPE uses principle similar to moving-coil. Here the coil is stationary and the magnetic field changes. As the stylus moves an iron rod closer to the pole pieces, the field across the coil changes. This induces a current in the stationary coil.

you choose must depend on what you have or are willing to add. All magnetic pickups need an equalized preamplifier. Some of the finest cannot be used at all with an automatic record changer.

Moving-coil pickups increase their output toward the high frequencies. This may help if your speaker or record is weak on the highs. But with a super-efficient tweeter, you may hear disappointingly shrill tones. The high-frequency rise is most pronounced in the ESL cartridges, which usually require a correction from a versatile preamplifier or a special network.

How much? In the budget department, the new ceramic pickups are worth a close listen. These save you real money

(Continued on page 240)



What you should know about

Using the New Man-Made Boards

By Paul Corey

CHIPS off the old block are now being pressed into man-made boards that have it all over the parent wood for many woodworking and home-repair jobs.

Unlike lumber, these highly useful new "chipboards" and "particle boards" won't warp or check. Like plywood, they come in big, thick panel sizes, and the cost is only slightly higher than that of top-grade plywood. But unlike plywood, they have no telltale, uneven-textured edges or hard-to-hide face ripples.

They're smooth. The new boards are as smooth-textured as hardboard, which they most resemble. But hardboard, useful as it is, has the disadvantage of structural weakness. It's brittle and usually must be framed or braced. Chipboards and particle boards have the beef to go



BECAUSE PARTICLE-BOARD TEXTURE is uniformly dense, sanded edges take clear finishes or paint as well as the panel faces. This shelved cabinet was made of decorative Novoply.

it alone. You can saw them, plane them, mill them and sand them just as you would ordinary lumber. They grip nails and wood screws firmly. On fussy jobs you can join them edgewise with dowel-and-glue joints. There's no troublesome grain-matching problem.

What makes these boards so much stronger than hardboard, the original man-made board, is a new approach to the manufacturing process.

How they're made. Hardboard is made by cooking wood under high pressure. When the pressure is suddenly released, the wood "explodes" into fibers. These fibers are then compressed into sheets, and the natural resins in the pulp act as a bonding agent. But the real strength of hardboard depends upon the crisscrossed fiber structure.

In the new boards, wood particles, flakes and chips take the place of fibers. Alone these particles would provide little matted strength. The beef comes from a tough binder of water-resistant synthetic resin with which the particles are coated before they are compressed. Far stronger than natural resins, this binder more than makes up for the absence of a fibrous wood structure.

Some chipboards and particle boards are rolled to full thickness from a single mix. In other boards, two or more thin sheets are laminated to produce a heavy

panel. Either way, the result is a highly stable construction material that is ideal for thin sliding and swinging doors, for distinctively textured furniture, and as a base for plastic laminates and veneers.

What to ask for. Until recently, commercial furniture and cabinetmakers have had a corner on chipboard and particle-board production. But with supply catching up with demand, more and more of these boards are showing up in local lumberyards. Among the brands now available or soon to be stocked are:

Novoply. This is the oldest trade name in the particle-board field. It's a laminated board with thin surface sheets made either from pine and fir flakes, or from redwood flakes—you have your choice. Medium-size chips are used for the thicker core of the panel. All surfaces are sanded smooth, ready for paint or clear finishing. Novoply comes in $\frac{3}{8}$ " and $\frac{1}{2}$ " thicknesses, and in panel sizes up to 4' by 8'.

Wabash Wood Particle Board. Made from ponderosa pine chips, this unlaminated board can be bought in thicknesses ranging from $\frac{1}{4}$ " to $\frac{3}{4}$ ". Panels come either veneered on both faces with birch, or unveneered for a finish of your own choice. The largest size is 5' 6" by 6'.

4-Square Particle Board. An unlaminated board made from Douglas fir particles that come sanded but not veneered.



TWO SCRAPS OF PARTICLE BOARD become one usable panel when you glue and cleat them together like this. There's no grain to worry about matching, or fear of splitting the edges.



UNFRAMED CABINET DOORS WON'T WARP if you make them of particle boards like the Wabash panels shown here. Rabbeting for a tight seal is easy; there's not a chance of splintering.



DOWEL JOINTS IN MAN-MADE BOARD are as strong as similar joints in lumber. After the glue has set under clamp pressure you can hand- or

power-sand the surfaces. Apply a coat of paint and you won't know that the joint is there. The boards shown above are $\frac{3}{4}$ " Panelply.

Thicknesses are from $\frac{3}{8}$ " to 1", and the panel size is 4' by 8'.

Panelply. Not a true particle board, but an even denser board made by laminating either two or three beefed-up sheets of hardboard. Both faces are smooth, hard and can be painted. Panelply comes in 4' by 8' sheets, and in $\frac{1}{2}$ " and $\frac{3}{4}$ " thicknesses.

They're easy to work. You can use ordinary hand- and power-driven wood-working tools to handle these boards. For clean results, the tools should be kept sharp. When sawing, a blade without much set is best. Carbide-tipped tools will pay off on production work.

For nailing, choose the same size nails you would for comparable thicknesses of lumber or plywood. You can drive nails close to the edges without fear of splitting the stock. You can also counter-sink finishing nails.

If you use screws, sheet-metal screws are somewhat better than regular wood screws. In either case, small pilot holes make driving easier.

For corner butt joints, always use nails and glue—not screws. This points up one of the few disadvantages of the new boards. Edges are almost certain to split if you try to drive in screws.

How to finish them. The surface textures of these grainless boards, particularly those of the particle boards, are so decorative that you may want to use a clear finish for an unusual and striking effect. You can do this with clear lacquer, varnish, or wax.

Unveneered particle boards will also take a first-rate paint job, after sanding. If you use Novoply or a laminated hardboard, the surfaces are so clear and smooth that not the slightest imperfection "mirrors" through.

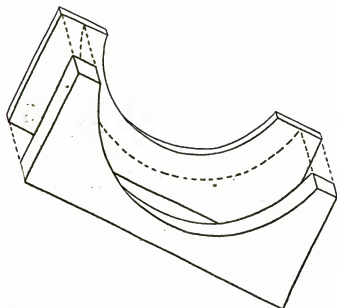
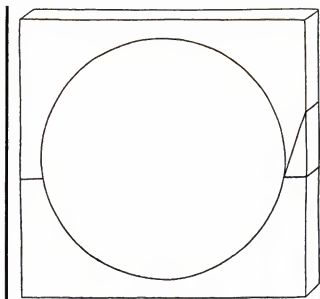
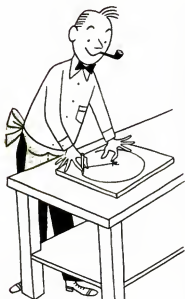
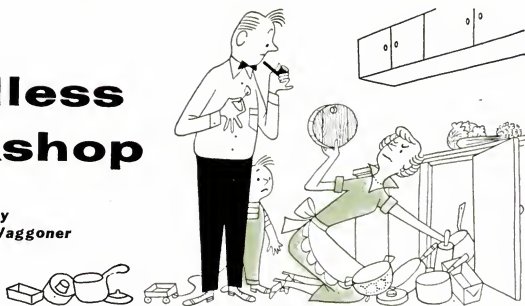
Before painting, make sure that the boards are clean and free from dust. Apply a prime coat and sand it lightly before following up with the finish coat. If you paint a panel that is to be used without framing, be sure to give both sides the same number of coats. This will prevent unequal drawing action which might bow the panel.

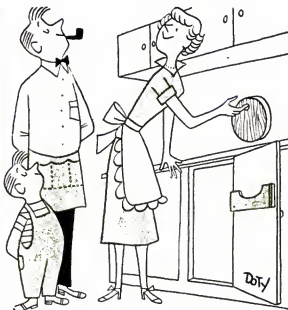
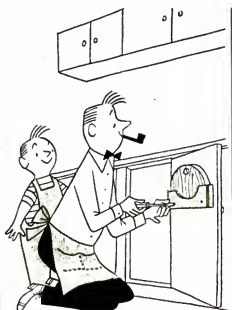
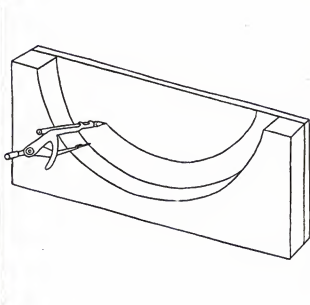
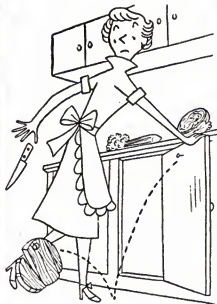
Use contact-bond cement when applying plastic laminations or veneers. The smooth undersurface will produce a slick and thoroughly professional job. **END**

For further information on particle boards and double- and triple-ply hardboards address: United States Plywood Corp., 55 W. 44th St., New York City (Novoply); Wabash Screen Door Co., 310 S. Michigan Ave., Chicago (Wabash Particle Board); Weyerhaeuser Timber Co., Tacoma Bldg., Tacoma, Wash. (4-Square Particle Board); and Masonite Corp., 111 W. Washington St., Chicago, Illinois (Panelply).

Wordless Workshop

By Roy Doty
and W. G. Waggoner





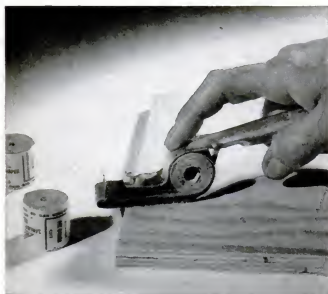
Next Month: A three-in-one chair, stool and desk for a child NOVEMBER 1956 223

New Tools

.....

1. Drill Set Includes Bench Plans. Along with standard attachments, this $\frac{3}{4}$ " drill comes with plans for a fold-away workbench. The drill set includes a steel carrying case, seven bits, sander and 5" circular saw. With them, you can build the bench and cabinet shown at right. The bench top is made of spaced boards to allow sawing on the table area.

More information about the new tools shown on this page can be obtained from: 1. Black & Decker Mfg. Co., Towson 4, Md.; 2. Sheldon Sporting Goods Co., 270 Lafayette St., NYC 12; 3. Empire Level Mfg. Co., 10930 W. Potter Road, Milwaukee; 4. Stanley Tools, 111 Elm St., New Britain, Conn.



2. Sander Uses Paper in Rolls. This sander for models and other small work holds a roll of 1"-wide sandpaper which you pull out as needed, tearing off the used length. Three refill rolls come in the kit. Turning the sander upside down gives you the use of a small scraper.



3. Level Has Viewing Aids. The vials in this new magnesium level snap in or out for easy replacement. Shatterproof magnifying lenses, built into the vial mounts, enlarge the bubbles for end-to-end visibility, and there is less interference from background shadow or reflection.

4. Steel Rule Locks Reading. When using this steel rule, you can push a button to lock its measurement in place. Push the button back, and the tape is automatically wound into the case. The underside of the rule gives direct inside readings that allow for the length of the case. Built-in scribes mark the work.



Step out with the New Kodak Signet 40 Camera

It's the color-slide camera specially designed to get the most out of today's fast Kodak Films and the new midjet flashbulbs!

You'll step out with confidence with a smart new Kodak Signet 40 Camera. It has the picture-taking range and smooth handling ease that lets you "get" color slides that others miss!

Ask your dealer about the Signet 40's superb f/3.5 Ektanon Lens and Synchro 400

Shutter, 1/5 to 1/400 second. Have a look at its exclusive dual-reflector flash system. Discover for yourself how fast you can sight, focus, shoot, and advance the films—with **all controls** at your finger tips.

The Kodak Signet 40 Camera, complete with flashholder and dual reflectors, is only \$65.



Dual reflectors for M-2 or #5 and #25 bulbs

Fast, handy, positive finger-tip controls

Rapid thumb-lever film advance

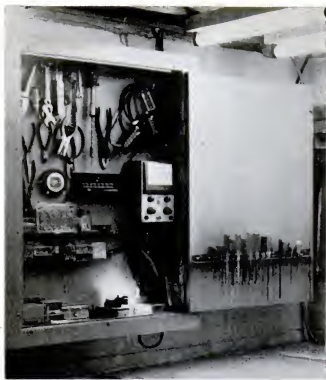
Combined rangefinder and viewfinder

Price includes Federal Tax and is subject to change without notice

EASTMAN KODAK COMPANY . . . Rochester 4, N.Y.

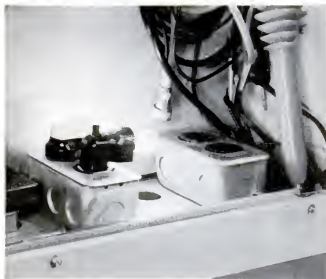
Kodak
TRADE MARK

NOVEMBER 1956 225



Heated Case Halts Tool Rust

I RIGGED up a utility outlet on the floor of my hanging tool cabinet, and now I never worry about the tools rusting. Using plug-in sockets, I burn two 7½-watt bulbs in the cabinet constantly during cool months and 25-watt bulbs in hot, humid weather. While I was doing the wiring, I installed a second outlet (photo below) for current for power tools.—*R. T. Luukinen, Washington, Ill.*



►►►Save old wallpaper cleaner and keep it handy in an airtight container. A wad pressed lightly over file teeth or rolled over typewriter keys will pick up filings or dirt efficiently and with no mess.—*Mrs. P. E. Fitzpatrick, Gary, Ind.*

Brush Is Hooked on Paint Can

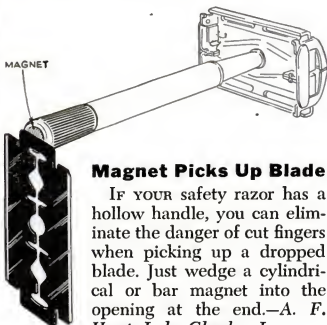
A T-SHAPED piece of metal, snipped from a tin can and bent as shown, lets you hang a paintbrush in a can of paint or turpentine.

Soldered to the brush ferrule, the upper hook fits in the rim groove and the legs rest on the inner lip to hold the bristles away from the side of the can.—*A. Zanelli, Tampa.*



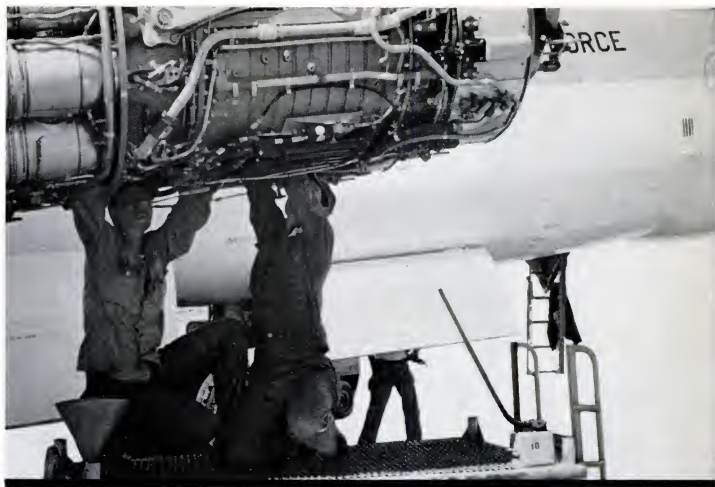
Shaped Keys Are Picked by Feel

You can find a key in a bunch by touch if you make the top distinctive. These six keys have been varied by bending up the rim, filing off a side, soldering a bolt in a hole, dropping solder on the face, boring extra holes (or slotting an edge) and filing V notches in the rim.



Magnet Picks Up Blade

IF YOUR safety razor has a hollow handle, you can eliminate the danger of cut fingers when picking up a dropped blade. Just wedge a cylindrical or bar magnet into the opening at the end.—*A. F. Hunt, Lake Charles, La.*



TRAINING IN THE U.S. AIR FORCE CAN PAY YOU BIG DIVIDENDS

As a man with mechanical ability, you have the opportunity to advance your skill in the U.S. Air Force. As an Airman you will train in the latest techniques of electronics, rocket propulsion, photography, or any one of over 40 career fields—and you earn while you learn! You'll see new places, too, make new friends, and work with men who share your interests. For now and for your future, find out about the dividends the U.S. Air Force can offer you. Mail the coupon now, or see your local Air Force Recruiter.

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All-Volunteer Team
—the **U. S.**
AIR FORCE

M-57-PB

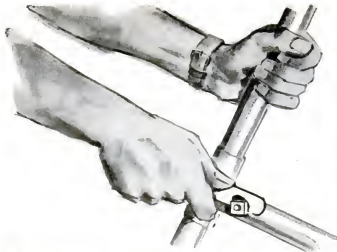
PASTE COUPON ON POSTCARD and mail to
Airman Recruiting Information Branch
Box 2202, Wright-Patterson AFB, Ohio

Please send more information on my opportunities
for enlisting in the U.S. Air Force. I am between
the ages of 17-34 and reside in U.S.A. or possessions.

Name _____

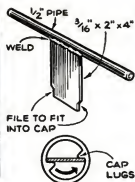
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Bottle Opener Serves as Spanner

If you want to tighten (or loosen) a nut or lug and haven't got a spanner wrench handy for the job, an ordinary pry-up bottle opener may do the trick.
—Frank Shore, New York City.



How to Make Oil-Drum Wrench

A WRENCH for easy removal of screw caps from oil drums and similar containers can be made from a piece of $\frac{1}{2}$ " pipe and a 2"-by-4" piece of $\frac{3}{16}$ " steel. File one end of the steel to fit against the lugs in the cap. Weld the other end to the pipe.—R. V. Thompson, Clinton, Iowa.

DO IT THE EASY WAY



DO KINKS DEVELOP in an extension cord when you store it? Prevent them by wrapping it around a large juice can.

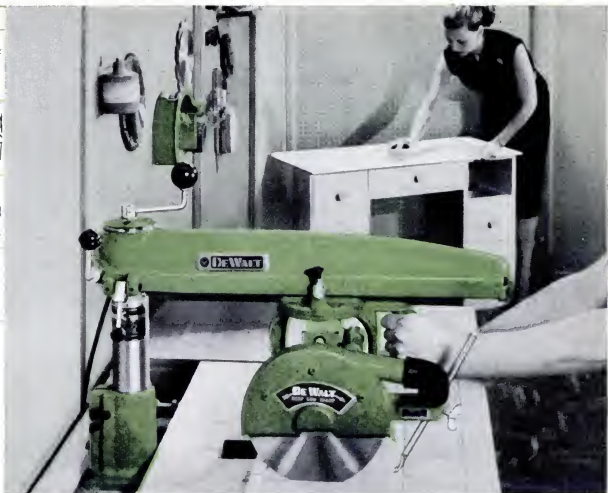
USE A PLAYING CARD as a marking template when installing a standard electric outlet box in a wall. Make saw cuts just within the pencil lines for a nice fit.



WRAP THE SCREWS in a cellophane cigarette package when you take down a screen door this fall. Tape the package to door.

IS THERE A JUMBLE of nuts, bolts, tacks, and the like in your storage workbench? Sort them out into a plastic ice tray.





Only \$239 delivered, complete with 9" saw blade and $\frac{3}{4}$ hp motor

Only AMF DE WALT makes making things so easy!

With a versatile AMF DeWalt® Home Power Shop, you can make home repairs, build furniture, handle even major projects like a *professional*!

AMF DeWalt is the *first* all-purpose power tool designed on the modern mechanical arm principle that outmodes all other power tools. It's actually 12 professional power tools in 1—a *complete home workshop*!

- Arm swings and locks at any position for miter cuts—gives easier, safer *top-side cutting* that eliminates errors... you see your mark and your cut.

- Builds into workbench! Because entire arm swings clear of work area, you can cut and assemble on the same work bench! Save valuable space and get extra convenience too!

- Powerful $\frac{3}{4}$ hp motor is U.L. Approved—guaranteed for full year—tilts and turns to any angle.

Motor carriage rolls smoothly on ball bearings in protected trackways. Simply change circular tool on direct-drive motor shaft and you have another power tool—at *no added cost*!

Superior safety and accuracy! Exclusive DeWalt Safety Key Switch prevents unauthorized use. DeWalt's patented design and rugged precision construction provides safety and unmatched accuracy that assures years of superior workmanship.

INSIST ON A DEMONSTRATION. See why, *feature by feature*, AMF DeWalt is the finest home power shop you can buy. A small down payment on DeWalt's Easi-Budget Payment Plan* will put an AMF DeWalt in your workshop now.

OWNERS! Valuable new Owner's Manual just off the press, "Easy Ways to Expert Woodworking," \$4.95 postpaid. Order yours today!

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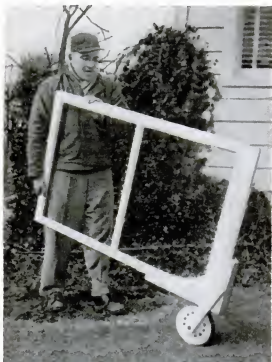
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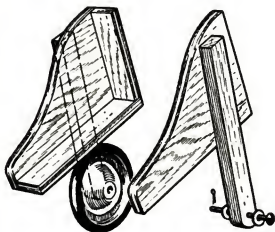
TIP OF THE MONTH:

Roll Out Those Storm Windows



THE month's best tip comes from John Nash, Sayville, N. Y. He says: "Handling storm windows twice a year can be made a lighter task for weary backs by the use of this unit.

"Some narrow wood strips, plywood, a wheel from a toy wagon, wood screws and a carriage bolt are the things you need to assemble this homeowner's helper."



Trouble-Shooting Fluorescent Lamps

(Continued from page 204)

"What's wrong, Mr. Willard?" Cam asked.

"Wrong? I paid an electrician to hook this up. It won't light. When I told Nichols, he said it never did work right. I want my money back."

Bud shrank visibly. "I—I haven't got it," he muttered desolately.

"How about a fixture that does work—and that I'll guarantee?" asked Cam.

Willard stopped fidgeting. "Same price—five dollars? Well, I guess so."

With alacrity Bud plugged in one of the fixtures he had cleaned and checked. After it had been alight a few minutes, Willard took it and left, much mollified.

"Whew!" breathed Bud. "Wonder what is wrong with the one he returned."

"Let's see," said Cam. He plugged the dummy starter in one socket, removed the other starter, and connected the fixture. One end of each lamp glowed.

"Wrong connections," said Cam, disconnecting it. "The starter leads have been crisscrossed from one lamp to the other. You can easily fix that, Bud."

I got up from the stool I'd been sitting on. "Guess I'll try shielding that garage lamp and see how it works."

"Good. Say, Jack, I think you could skip the bifocals if you'll buy this two-lamp fixture from Bud."

I shook my head. "I've got a two-lamp job over the lathe. I know AC flicker from a single lamp can cause stroboscopic effects, like the wheels that turn backward in Western movies."

"What if both your lamps are flickering in step?" Cam demanded.

"Huh? But I thought two lamps—"

"Low-priced two-lamp units just naturally stay in step," Cam explained. "It takes a more expensive ballast, with extra chokes and condensers, to make the two lamps light out of phase. This one of Bud's is that kind."

"I'll be darned. Bud, I'll give you five dollars for it, and throw in my two-lamp fixture as a trade-in."

"Sure, Mr. Foster. Boy, business is good," gloated Bud. "It's a bargain!" END

STANLEY STEELMASTER

The Finest Hammer Ever Made

Driving nails is work — no doubt about it. But it's also the kind of clean, thumping exercise a man can enjoy. There's smacking satisfaction in belting a shiny tenpenny into stout 2 x 4 studding. This is the hammer to use . . . for accuracy, authority and pleasure . . . it's the Stanley STEELMASTER, the finest hammer ever made.

TEMPERED RIM MINIMIZES CHIPPING

Exclusive! Rim of striking face is induction tempered to minimize chipping.

LOCKED-ON HEAD — The head is permanently locked to the handle; it will never come loose.

CHROME ALLOY HANDLE — Special chrome alloy steel handle *will not break!* It flexes a little, it absorbs vibration, but it will not break. Chrome plating prevents rust.

ACUSHNET CONTOURED GRIP — Good-to-the-hand neoprene forms a non-slip, cushioned grip. It won't mar either, so the butt end can be used to tap work into place.



FREE "HAMMER HOLSTER"

Introductory extra! Your hardware dealer has free leather holster to keep STEELMASTER within reach when you're working.

Hammers up, men. Pick the finest made — the Stanley STEELMASTER. In 13, 16, and 20 oz. sizes. For useful nail chart send 10¢ to Stanley Tools, 63N Elm St., New Britain, Conn.



STANLEY

THE TOOL BOX OF THE WORLD

Gus Joins the Rescue Squad

[Continued from page 180]

power stays on. That's the chance we'll have to take."

"I'll have to take," Maloney snapped. "I'll go up myself. I wouldn't ask any man under me to take such a risk."

Gus felt a hand on his shoulder.

"I'll go," a voice said. "Let me go, Mr. Wilson—please."

Gus turned, and through the open door of the ice plant the light from the flames lent the features of Tommy Brown a haggard look beyond his 18 years. He stood there, thin-shouldered, gangling.

"They say I set this fire," he said. "I didn't. Telling a person you'd like to see him burn is just a saying the kids have. When Mike fired me I got riled, but I wouldn't—"

"Stand back, kid," Maloney bellowed as he dove through the ice-plant door, waving at his crew. "Men, get those hoses on this conveyor. I'm going up."

Tommy Brown was at Gus's side as he leaped after Maloney, and then he was gone. Looking upward, Gus saw the youngster clinging to the moving conveyor chain, already out of reach. Gus and Maloney ran back into the ice plant. Gus put his hand over the switch.

"If we stop it now, Maloney," he said, "the kid may burn halfway up. We've got to let him go. Get outside and tell me exactly when you want the conveyor stopped, and when to reverse it."

GUS didn't know what was going on outside, but he knew what he had to do in the ice plant. Two lives depended on his quick, sure actions. There were 440 volts of juice connected to this motor. A blown fuse, a moment's hesitation, a wrong move, would be fatal. Gus stooped, selected two wires, spread them apart from the others.

"Gus," Maloney bellowed, "the kid's in the tower."

Gus slammed off the switch lever. Swiftly he separated the two wires he'd selected, reversed them, twisted them into two pairs again.

"There he is!" Corcoran's voice was a

scream. "He's got Pagett. Pagett's out on the chain."

"Bring him down, Gus! Bring him down!" Maloney roared.

Gus threw the switch even as his last movement twisted the wires together, and the motor hummed in the opposite direction. The top half of the endless conveyor chain now moved down from the ice tower instead of up. Gus ran outside and looked upward to see Mike Pagett's body stretched full length on the chain. Behind him, face down, lay Tommy Brown, clutching his shoulders. A lash of wind-whipped flame from the roof enveloped the pair for a moment, and then they were in the clear, coming down, clothing blazing.

"That," Jerry Corcoran breathed, "is the bravest act I ever saw in my life. That kid couldn't have set this fire, Gus."

FIREMEN rushed forward to lift the unconscious Pagett from the conveyor and beat out the fire on his clothing. Gus helped Jerry Corcoran support Tommy Brown as they put him into the police car and rushed him to the hospital. A few minutes later Gus had a near-hysterical mother on the phone.

"Tommy's in the clear, Amelia," he told her. "You see, as soon as Mike fired him he went right to work at the lumberyard, piling lumber. That's right. Jerry Corcoran's already checked it—he was there all day."

"But you said you were phoning from the hospital. Is Tommy hurt?"

"Singed a bit," Gus said. "A few black and blue spots where the conveyor chain pinched him. You can expect him home in an hour, safe and sound."

"Conveyor chain!" Mrs. Brown queried. "What do you mean, Mr. Wilson?"

"I mean," Gus told her, "that your son is a hero, Amelia. He saved Mike Pagett's life . . . You can tell him from me that whenever he needs a father I'll be proud to act in that capacity." END

NEXT MONTH: Gus tackles some strange machinery.

IDEAS FROM WELDWOOD

THIS MONTH'S PROJECT— BUILDING CHILDREN'S FURNITURE FOR CHRISTMAS

This Christmas, you can have a richly rewarding time, and save money on Christmas presents, by giving your children furniture and toys you built yourself. And there are plenty of project ideas in the just completed 144-page book "Children's Furniture You Can Build." (See coupon to get your copy.)

Building any one of these pieces of children's furniture—like those shown on the right—really isn't hard. The well-illustrated book gives careful step-by-step directions. And, to insure your satisfaction, author-designer Bill Baker recommends Weldwood products be used. Weldwood hardwoods—like Samara* and Nakora*—are inexpensive, easy to work and strikingly beautiful. And old-time favorites—like Weldwood fir plywood and Weldwood glues—are used to make even hard-looking jobs easier. You'll find that both amateur and professional woodworkers enjoy using Weldwood products because they can be sure of extra quality.

So, for Christmas gifts your children will enjoy using and you'll enjoy making, send for "Children's Furniture You Can Build."

*Trademark



Old-fashioned cradle is made of Weldwood birch plywood.



Wardrobe-Chest of Drawers will delight any young Miss.



"Desk 'n' shelves" solves youngsters' toy storage problems.



Ride 'em cowboy, on a safe, sturdy Weldwood Rocking Horse.

This Month's Hint

To make a stronger than normal water-mix putty, substitute Weldwood Presto-Set Glue for the water. W. S., Elmira, N. Y.

The Weldwood Question Box

Q. I want to install some Micarta® with Contact Cement, but I'm afraid I won't position the Micarta correctly and—since Contact Cement bonds instantly—I'm afraid I'll ruin the job. Any suggestions?

A. Actually, it's pretty hard to go wrong if you follow these di-

rections carefully. (1) Coat both surfaces with Contact Cement and let dry. (2) When the surfaces are dry, put a sheet of paper covering the surface on which the Micarta is to be placed. (3) When that's in place, position the Micarta carefully . . . slowly pull out the paper, pressing the Micarta in place. The

Micarta will bond instantly and permanently.

However, if your hand wobbles, or if you do make a mistake, good lacquer thinner will dissolve the bond temporarily and allow you to remove the Micarta. After a short drying time, the bond may again be made without additional Contact Cement.



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Weldwood—The Best Known Name in Plywood

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Enclosed find 75¢ for which please send me the Fawcett Book "Children's Furniture You Can Build," by Bill Baker.

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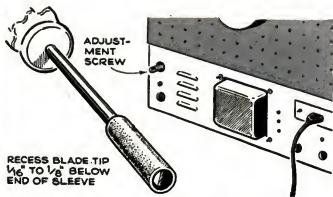
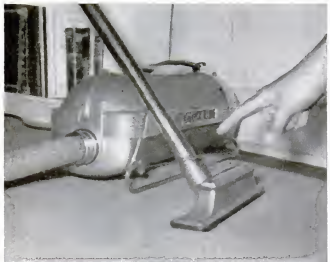
Chalk Touches Up Drill Size

IF YOU point up drill-size markings with chalk, you will make them easy to see. Rub the chalk in and brush off the surplus. The treatment lasts some time.

▶▶▶ To remove a broken tool handle, saw it off close to the head of the tool and clamp the head in a vise with the cut wood facing up. Then, with a hammer and a square nut a bit smaller than the eye of the tool when held edgewise, you can drive out the remaining handle stub.—J. L. Cross, Blue Mounds, Wisc.

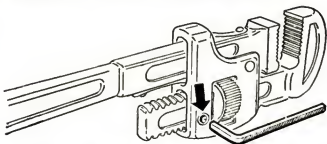
Swing-Away Hook on Vacuum Tank Supports Cleaning Wand

A HOOK on a vacuum-cleaner tank eliminates stooping to pick up the wand every time it is put down. Bend up a 6" length of 3/16" rod and attach it at the



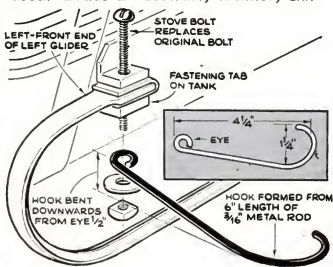
Screwdriver Sticks in Slot

EVER try to watch your TV screen in a mirror while turning the adjustment screw on the back? To help you keep the screwdriver in the slot, fit a metal or plastic sleeve over the blade. The sleeve should extend slightly beyond the tip.—Charles J. Moore, Wolfe City, Tex.



Screw Locks Adjustable Wrench

A SETSCREW in the sliding jaw of an adjustable wrench will keep it from slipping out of position. By taking out the fluted screw, you can remove the jaw for drilling and tapping one side.—William B. Goodrich, Somerville, Mass.



**24% more
road horsepower
—for hill climb!**



**24% more
road horsepower
—for passing!**



In cars that have gone about 10,000 miles without a spark plug change—

New Champions can increase road horsepower by 24%!

Tests with major makes of cars prove it! Independent engineers took cars whose plugs had run 10,000 miles or so and tested them for power—first with their regular plugs, then with 5-rib Champions with the new Powerfire electrodes.

Nothing about these cars was changed except their spark plugs. Yet there was an *immediate* increase in their road horsepower—the real power actually delivered at the rear wheels! *The average road horsepower gain for all cars tested was 24%!*

It comes down to this: There just never has been a spark plug to match these new Champions with their Powerfire electrodes! Replace your old plugs with new 5-rib Champions today—and you'll feel the difference *at once!*

CHAMPION

LOOK FOR THE 5 RIBS



ORDINARY ELECTRODE

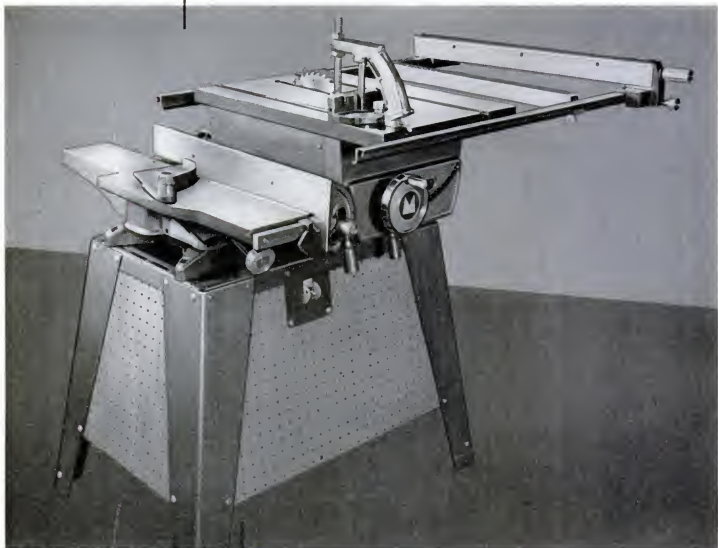
POWERFIRE ELECTRODE



New Powerfire electrode stands up better in today's engines. Photo shows how ordinary electrode burns away. Champion's Powerfire electrode, after identical use, is still good for miles of powerful service!

NEW!

MAGNA INTRODUCES LARGEST CAPACITY SAW-JOINTER



**OPERATES
WITH SAW BLADE
AT ANY
HEIGHT!**

The new Magna Saw-Jointer combines two of America's finest power tools: the revolutionary new Magna 9-in. Saw with "The Helping Hand"—a built-in extension which makes the largest effective table on the market; and the big Magna 4-in. Jointer with the longest table and largest fence in its class. The Jointer operates at *any* height of the saw blade, eliminating frequent adjustment required by other saw-jointer combinations. You can buy the Magna 9-in. Saw now and convert to this big Saw-Jointer later, with the inexpensive Magna Saw-Jointer Adaptor Kit.

Own the Magna Saw-Jointer for as little as \$3 a week!

MAGNA 9-in. Saw with "The Helping Hand"



The only tilt arbor saw with "The Helping Hand"—a built-in extension which makes the largest (34" x 24") effective table on the market, allows bigger rip and cross-cut capacity than any other saw • Epicyclic Speed-gear Control gives you full 45° tilt with only 10 turns of knob, (40 to 60 turns on other saws!) • Single-knob control—push for projection, pull for tilt • Self-aligning Fence locks front and back with single knob • colored Safety Zone Table Insert cannot catch work piece • exclusive pressure-cast tub front bolted rigidly to table, coordinates all controls • externally adjustable Tilt Stops • 3 Auto-stops on Miter Gauge • Magna Saw-Jointer Adaptor Kit contains all you need to convert to Magna Saw-Jointer!

MAGNA 9-IN. SAW (without motor or stand) — ONLY \$99.95!

MAGNA 4-in. Jointer with Longest Table, Largest Fence



The big, heavy-duty Magna 4-in. Jointer gives you the longest (28") table, and largest (3" x 21 3/4") fence of any 4" jointer • Adjustable in-feed table, fixed outfeed table • One-knob Fence Lock controls tilting of fence • Auto-stops at most used angles • One-piece fence casting is far more rigid, larger (21" x 3") • 3 high-speed safety tapered steel knives are individually micro-adjustable • spring-controlled Safety Guard can be used on other side of fence when rabbeting.

MAGNA 4-IN. JOINTER (without motor or stand) ONLY \$49.95!

**OWN THE NEW MAGNA SAW-JOINTER
FOR AS LITTLE AS \$3 A WEEK!**



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Please send me a free 16-page Magna-Line catalog.

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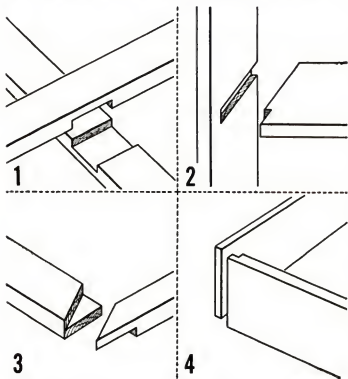
Street Address _____

City _____ Zone _____ State _____



Nicholson Joint Quiz

How many of these woodworking joints do you know?



Answers: 1. Cross lap. 2. Blind dado. 3. Mitered half lap. 4. Rabbet.

You home workshop hobbyists use joints in practically every project you undertake. And if you're hep, you also use Nicholson or Black Diamond cabinet files and rasps to make those joints fit as snugly as possible. Even the most accurately cut joints require that extra touch of smoothness that only fine files can produce—files by Nicholson and Black Diamond.

FREE! "File Philosophy," 49-page book on types, use and care of files. Excellent handbook for the do-it-yourselfer. Write for your copy soon.



NICHOLSON FILE COMPANY
Providence, R.I.

(In Canada: Nicholson File Company of Canada Ltd., Port Hope, Ontario)



NICHOLSON FILES
A FILE FOR EVERY PURPOSE

This Ship Died—but Lived Again

[Continued from page 172]

strip of welding. The final joining was made simultaneously at many points around the ship. By Sunday morning, Aug. 21, 1955, the joining of the hull was complete.

In addition, half a mile of oil piping had to be renewed and hooked up, and four miles of heating coils.

Problem: How to keep the *Concord* from splitting again?

A crack-arresting system was installed. Four long, lengthwise rows of slots—two on deck and two on the bottom—were cut into the vessel. A crack opening in deck or bottom will stop when it reaches a slot. Over each row of slots, there was riveted a steel strap—half the length of the ship. This strap covers and waterproofs the slots. Crack arresters like these

.....

Nothing raises your opinion of your immediate neighbors like a conversation with a prospective buyer of your house.

—THE SIDEWALK SUPERINTENDENT

.....

are often added to American-built ships to reduce the chance of a break-up.

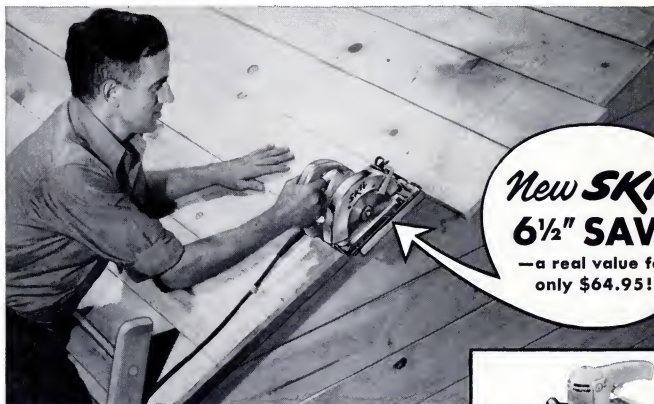
The *World Concord* left drydock on Sept. 5, 1955.

On Sept. 6, she resumed her journey to the Near East. Later, she came into Philadelphia, and Americans got their first look at the ship that died but lived again.

Because of the crack arresters, she is today a better and stronger ship than before she split apart. She also has more capacity. Because of her added strength, she was given a deeper load-line and is allowed to carry 821 more tons of oil than formerly.

"The difficult," as a popular saying of men of action goes, "we do immediately; the impossible takes a little longer." In the case of the *World Concord*, the impossible took—from the day the big oil tanker broke in two until the day she sailed from Antwerp—exactly nine months and one week.—Gardner Soule.

PERFECTLY BALANCED for easier one-hand operation!



**New SKIL
6 1/2" SAW**
—a real value for
only \$64.95!

Any experienced craftsman will tell you that a power saw should be *easy to handle . . . powerful . . . able to make all cuts with quick, simple adjustments*. Because the SKIL Saw is superior in all these ways, it is the favorite of those who know tools best.

For example, the SKIL Saw *balanced design* lets you cut faster and much easier. Take a SKIL Saw in your hand . . . it's always in a level, horizontal position, and the other hand is free to hold the work.

In every detail, SKIL Saw gives you the *feel and performance* of a quality tool. Its telescopic automatic blade guard for greater safety . . . fingertip bevel and depth adjustments for flexibility of use . . . hardened steel helical gears for full power and longer life—are just a few of the many valuable features that make the SKIL 6 1/2" Saw outstanding.

See it and other famous SKIL Tools at your hardware or lumber dealer today.

OVER ONE MILLION
SKIL SAWS IN USE



Made only by SKIL Corporation
formerly SKILSAW, Inc.
5033 Elston Avenue, Chicago 30, Illinois
3601 Dundas Street West, Toronto 9, Ontario
Factory Branches in ALL Leading Cities



**SKIL Orbital Sander—
Model No. 592**

Sands flush into corners . . . right up to vertical edges. Abrasive paper clamps hold up to six sheets for fast paper changes. TUF-TEX finish for sure grip. Only \$49.95.



**SKIL Drill Kit—
Model No. 587**

Use it for drilling, sanding, grinding, polishing, and many other household jobs. Includes Model 549 Drill with geared chuck, 10 accessories, carrying case. Only \$29.95.

• • • • •

LOOK for this SKIL Tool Center Display at your local hardware or appliance dealer . . . or any leading department store . . . for the finest in power tools.



Which *finishing* Weldwood[®] Wizard can help you today?



It's a good idea to keep them all handy. You never know what finishing problem may develop in working with wood. As products of the world's largest plywood organization, these "wizards" are designed to give you expert results in many finishing tasks.

For protecting and bringing out the natural beauty of any wood—use **SATINLAC[®]**

Makes the most practical, beautiful and durable natural finish for hard or soft wood! So quick-drying you can apply 3 coats a day. SATINLAC is so easy to maintain!



For blond woodsy effects without a "painty" look—use

WHITE FIRZITE[®]



Versatile! A two-fold boon:
(1) As an undercoater for soft wood or plywood paint jobs, seals pores to help prevent grain raise and checking.
(2) As a finish, produces a blond woodsy finish with no "painty" look. Great for pickled and wiped effects too!

For making fir plywood look like costlier woods—use **CLEAR FIRZITE[®]**

Magic action for plywood stain jobs! Tame wild grain with a starting coat of Clear Firzite—add colors in oil to achieve the rich look of oak, walnut, mahogany. Clear Firzite also helps prevent grain raise and face checking.



Ask your hardware, paint, or lumber dealer about these Weldwood Finishing Wizards... or mail coupon for FREE leaflets.

UNITED STATES PLYWOOD CORPORATION
Box 525 — New York 46, N.Y. PS11-65

Send me leaflets on:

☐ Satinlac ☐ White Firzite ☐ Clear Firzite

NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

How to Choose the Right Pickup

(Continued from page 218)

because they need no equalizing networks or pre-amplifiers. The samples of the Electro-Voice Ultra-Linear, Shure Music Lovers Cartridge and Sonotone "3" series that we tested checked out creditably on meter and oscilloscope tests—and sounded good, too.

The most widely sold hi-fi pickup of them all is the GE Variable Reluctance. And for good reason: you'd be hard-pressed to find a better one for the money.

Another outstanding performer for little money is the Ronette, an imported crystal job with amazingly low distortion even at high amplitudes. Unfortunately, it lacks a diamond microgroove stylus.

How it sounds. Even the most slide-rule-happy engineer warns that the proof of a pickup is in the listening. And it depends on what you want to hear.

If your interest is general musical content (you'd rather not hear the squeak of rosin on a violin string) then you'll probably like the Audax. It's not cheap, and the sample we tested produced practically nothing over 12,000 cycles, but it is a smooth, sweet-sounding job over the range that matters for music.

But if you're a really sharp listener who relishes the drama of tinkling triangles and the last shimmer after crashing cymbals, only the widest range cartridges will satisfy you: the Pickering, ESL or Fairchild, for example. These show what can be reproduced from a fine, full-range record. On a run-of-the-mill record, they may not always sound as good as others. We checked this by playing the same record with two pickups—both high quality, but of differing frequency range—for a group of critical listeners. With some records, they often preferred the pickup of moderate range.

A lot of people like a slight stridency in high notes; others (women particularly) object. If you favor this edginess, try a Miratwin on your records.

You have to make the final choice. So play several on the same record, using your home hi-fi equipment if possible. You'll hear the difference.

END

Which Weldwood® Wizard can help you today?



What are you making or mending? Do you know about Weldwood's new developments in adhesives? Do you know that you need special glues for special jobs? Do you keep on hand all 4 of these Weldwood Wizards, developed to make your jobs easier, quicker?

For wood-to-wood joints that never come loose—use **WELDWOOD Plastic Resin GLUE**

Imagine—joints glued with this Wizard are stronger than the wood itself! And they grow even stronger with age! That's why it's America's most popular wood glue. Highly water-resistant, stain- and rot-proof. Easy-to-mix powder. 15c, 35c, 65c and larger sizes.



For weatherproof boat repairs—use **WELDWOOD WATERPROOF RESORCINOL GLUE**

100% Waterproof! A "must" for any wood gluing exposed to climate, boiling or salt water, cold weather, mold, fungus, mild acids, alkalies, etc. Terrific for sporting goods, woodwork in damp basements, lawn furniture. ¼ pints, pints, quarts, gallons.



For in-a-hurry gluing of wood, paper, cloth, fabric—use **WELDWOOD PRESTO-SET® GLUE**

Ready to use. Sets fast! Glues like magic! Presto-Set is the Weldwood-perfected white glue that bonds wood to wood, wood to cloth, cloth to paper, upholstery fabrics to wood, leather to leather, etc. Clean to work with—no sticky hands. 19c, 29c, 49c tubes; pint and quart jars.



For putting up plywood panels without nails—use **WELDWOOD CONTACT CEMENT**

Revolutionary! Speedier, easier, new way to install plywood panels. No nails, no holes to fill and finish. Bonds instantly, permanently on contact. No clamps and presses—ideal for applying plastic laminates like Micarta to table tops, kitchen counters, etc. 1001 other uses for home, hobby, garage. 29c, 40c, 70c and larger sizes.



There's a special Weldwood Wizard for every gluing job. Ask your lumber, paint or hardware dealer... or mail coupon for FREE leaflets.

UNITED STATES PLYWOOD CORPORATION

Box 525 — New York 46, N. Y.

PS11-6G

Send me leaflets on:

- ☐ Weldwood Plastic Resin Glue
- ☐ Weldwood Waterproof Resorcinol Glue
- ☐ Weldwood Presto-Set Glue
- ☐ Weldwood Contact Cement

NAME _____

ADDRESS _____

CITY _____

ZONE _____

STATE _____

Turn your basement into a FUN-AND-HOBBY ROOM for only \$16⁰⁰ a month!*



It's easy to do with Gold Bond Building Products



Build a room like this in your basement—or in *any* waste space. It's a cinch with **Gold Bond Building Products**... made to *work together*.

Strong, sturdy walls are **Gold Bond Gypsum Wallboard**. Big, lightweight panels are easy to apply. Simply saw like lumber, or score with a knife and snap off. Conceal joints with **Gold Bond Tape Joint Treatment**.

On the ceilings use **Gold Bond Insulation Tiles**. Quickly applied; interlocking edges hide nails or staples.

Finish with **Gold Bond Velvet**—world's finest latex paint. Goes on with brush or roller, dries in minutes, washable. Clean equipment with water.

See your local **Gold Bond® Dealer** for all building, remodeling materials.

*BASED ON COST OF MATERIALS SPREAD OVER 36 MONTHS.
PRICES VARY SLIGHTLY IN SOME LOCALITIES.

SEND FOR
ILLUSTRATED
BOOKLET

Gold Bond
BUILDING PRODUCTS



National Gypsum Company, Dept. PS116
Buffalo 2, New York

Please send me Gold Bond "How-to-Do-It" Plan #18, showing me how to build a basement fun-and-hobby room. Enclosed is 10¢ to cover mailing.

Name _____
Street _____
City _____ Zone _____ State _____

The Machine That Indexed the Bible (Continued from page 175)

occurs. All concordances of the past had been made by Biblical scholars like James Strong. A scholar can tell, from his years of study, how much of a sentence or phrase he must include to be sure you recognize the quotation.

But how was Univac, the electronic moron, to read the Bible and select the right quotations? How was Univac to do this job that had always required human judgment, and that had earned honorary degrees for highly trained minds?

Bosgang's instructions had to be in the form of a problem in arithmetic. He spent 13 weeks drawing them up.

WHEN he got through, he had expanded Rev. Ellison's original one-and-one-half-page letter into a problem that contained 1,800 separate instructions for Univac to follow.

Bosgang told Univac it was to read the Bible till it came to a key word. Then it was to pause, and to scan electronically the words before the key. It was to read backwards till it came to a stop—a period or space, for instance. Then it was to read ahead, past the key word, till it came to another stop. Univac was to put down the complete phrase from the stop before to the stop after the key word.

Thus, if the key word was the first in a sentence, Univac, reading backwards, would immediately come to a period and halt. It would then read forward and record the key and its following words. If the key was the last word, Univac, reading ahead, would stop at the period immediately after it, and would record the key plus words before it. If, on the other hand, the key word was neither first nor last, but in the middle of the phrase or sentence, Univac would record the words on each side of it.

In any case, Univac—and the finished concordance—would give you the quotation you sought when you consulted the concordance.

Bosgang's 1,800 instructions, on tape,

[Continued on page 246]



So light, a cord table can be your workbench.

The Whole Family Has Fun!

- with your gift of a
Dremel Moto-Jig Saw

There's no finer gift than a Dremel Moto-Jig Saw. It adds new thrills to woodworking—makes it a happy family hobby. It's good, constructive recreation and very educational for children—teaches them to be creative.

It's Super Safe

Only Dremel has a specially designed blade guard that keeps young fingers away from the blade—makes it **SUPER SAFE**. Now the whole family can enjoy working with a power saw. It's portable too—even a card table can be your work bench. These features have made Dremel the No. 1 choice for handicraft work in cub scouting, elementary schools, churches, 4-H clubs, etc.

A Professional-Quality Tool

A precision-built craftsman's saw—not a toy. It's run by a powerful **ROTARY MOTOR**—not a reciprocating vibrator. The new **ROCKER-ACTION** principle actually outperforms all others, even much more expensive ones. It practically eliminates blade breakage. Cuts $1\frac{3}{4}$ " wood. Absolutely no maintenance or burnout problem.

Prove it to Yourself

Go to your hardware or hobbycraft store. Inspect the Dremel Moto-Jig Saw closely—compare it with others before you buy. You'll find Dremel is far superior in every way. Invest in wholesome, family fun—buy a Dremel Moto-Jig Saw.



Model 15

15" throat—cuts to center of 30" circle

\$29.95

Model 8

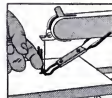
8" throat—cuts to center of 16" circle

\$23.50

Prices include **ROTARY MOTOR**



ONLY DREMEL HAS THESE FEATURES



Super-safe blade guard protects young fingers from injury.

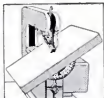


Table tilts for bevel cutting. Table can be raised or lowered also to utilize every part of the blade.



New **ROCKER-ACTION** principle replaces old-fashioned spring-tension assembly. Blade remains uniformly taut—cuts faster—blades rarely break.

New, Exciting Pattern Packets. Eight new, Pattern Packets supply you with plenty of useful, interesting things to make.

Get started now by ordering Packet No. 1. It includes full-size patterns for 16 projects (tile rack, earring holder, two games, etc.) Send coupon with 75c today. Write for folder on other packets.



SEE YOUR DEALER. If he can't supply you, order direct on 5-day trial, money-back guarantee!

DREMEL MFG. CO., Dept. 126L, Racine, Wisconsin

Enclosed is ☐ check ☐ money order for \$.....in full payment for one Model.....Dremel Moto-Jig Saw. If not satisfied, I can return it in 5 days and get my money back.

Enclosed is.....\$ for Pattern Packet No. 1.

Send me free ☐ Folder on 8 Pattern Packets ☐ Power Tool Catalog.

Name.....

Address.....

City.....Zone.....State.....



Start your
DELTA
HOME WORKSHOP
for as little as **\$9.95**

IT'S SO EASY TO OWN THE BEST!

There's no need to put up with second best when you can enjoy real DELTA Quality Power Tools—the fine tools that set the standards for all others—for only 10% down. For instance, as little as \$9.95 is all you need to start a real home workshop with the big, brand new DELTA 9" tilt arbor saw. Or for just a few dollars you can take home the new, bigger and better Delta-Shop or the great new DELTA "900" radial saw—or any other DELTA tool.

Your Delta Dealer can help you select the *right* tools for *your* needs because DELTA makes the world's most complete line of both individual and combination tools.

Visit your DELTA Dealer today—he's listed in the Yellow Pages of your phone book. Or see DELTA Homecraft Tools at leading department and hardware stores.

See how *easy* it is to own the *best*!



NEW!

DELTA 9" Tilt Arbor Saw

... starts your shop
for as little as

\$9.95 down

Ideal "first" tool for your workshop because it's the basic tool of all wood-working. Biggest saw value you've ever seen.



NEW!

DELTA "900" Radial Saw

... yours for as little as

\$23.90 down

World's most powerful, most useful all-purpose 9" radial saw. Rips, drills, routs, sands, grinds, shapes, cuts mouldings and does many other jobs.



NEW!

Bigger, better DELTA SHOP

... complete workshop for
as little as

\$28.95 down

Famous all-in-one workshop now with big, brand new 9" tilting arbor saw, plus jointer, drill press, sander. Does 90% of all woodworking jobs.

Get your free Power Tool Guide

Delta Power Tool Division, Rockwell Manufacturing Co.

5041 North Lexington Ave., Pittsburgh 8, Pa.

☐ Please send me free illustrated Power Tool Guide.

☐ Please send me names of Delta Dealers near me.

Name

Address

City County State



another product by
ROCKWELL



It's Tops...



Sizes
for any
pipe cutting
need

for quick clean cuts . . .

RIGID

Heavy-Duty Pipe Cutter

Powerfully built—guaranteed not to warp or break, always tracks perfectly . . . Famous **RIGID** thin-blade or heavy-duty cutter wheels of tool steel roll easily, cleanly through any pipe. Special wheels for stainless steel, cast iron. Every cutter factory-tested. For your work or home, it's most for your money—buy it at your Hardware Store!

Genuine
RIGID
The World's Most
Popular Pipe Wrench



The Ridge Tool Company, Elyria, Ohio, U. S. A.

The Machine That Indexed the Bible

[Continued from page 242]

went into Univac's memory. And back into Univac went the key-word tapes and the Bible tapes.

Out flowed 26 new tapes containing key words, their locations, and the sentences or phrases around them.

SOME of these latest tapes were placed in machines called Uniservos. The Uniservos were connected to Uniprinters—operatorless electric typewriters. They type out in English what Univac has recorded in figures on the tape.

At this point the prospective publisher of the concordance paid one of his frequent visits to the project.

This gentleman, William R. McCulley, president of Thomas Nelson & Sons, had known of the difficulties of the job.

But he was gratified as he watched Uniprinters reel out complete entries for the concordance like these:

ANOTHER

and said to one A., "who then is #Mk 4:41 And they discussed it with one A. #Mk 8:16

Early tests showed that Univac, 80 percent of the time, was duplicating the entries made by Biblical scholars in concordances for other editions of the Bible.

So right were the instructions that in no case was Univac coming up with sentences or phrases you wouldn't recognize.

IT TOOK Univac 100 hours to fill the 26 tapes with the list of all entries the concordance would use. These entries were not yet in alphabetical order. But the job was downhill now. It took two routine operations and 100 hours for the moron to alphabetize them.

After editing, the final tapes, containing the concordance as you will see it in the book, were placed into Uniservos hooked up to the operatorless typewriters, or Uniprinters. These typed the concordance as it would go to the printers. Time: 1,000 hours.

Graham, Bosgang and Univac finished the concordance, according to best estimates, 23 years earlier than it would have taken Biblical scholars to do it. **END**

New Porter-Cable quality saw makes every professional cut! Only **\$54⁵⁰**



Big saw performance! Porter-Cable's new Model 160 Saw gives you exclusive features found *only* in Porter-Cable quality Saws — at a sensational, new low price!

It makes every professional cut, including compound miters, in full 2" dressed lumber. It provides all the power, speed and cutting capacity you'll need in a saw.

You get the famous Porter-Cable Kick-Proof Clutch, telescoping guard, precision ball bearings and instant depth and bevel adjustments, for accuracy and ease of use.

You can't beat this value anywhere...and the special introductory offer makes it your one *best* saw buy!

SPECIAL INTRODUCTORY OFFER!

Expires January 31, 1957

SAVE \$5.00 when you purchase the sensational new Model 160 Saw in kit form.

\$64.50 Value—Now only \$59.50

Kit Includes:

Model 160 6½" Saw

Rip Guide for fast, accurate ripping all dressed 2" lumber up to 45°

Carrying Case...constructed of strong, welded steel for full protection and durability

SEE YOUR DEALER—OR MAIL COUPON TODAY!

- PORTER-CABLE MACHINE CO.
- 614A N. Salina St., Syracuse 8, N. Y.
- Please send complete information on Model 160
- Saw, and the name of my nearest dealer.

Name

Address

City Zone State

Porter-Cable

Quality Electric Tools

In Canada: write Porter-Cable, Ltd., Box 5019, London, Ont. Canadian prices slightly higher.

NOVEMBER 1956 **247**

GIVE the INDISPENSABLE GIFT for all HOME CRAFTSMEN!



A HOME-SHOP SCREW DEPT.!

BY SOUTHERN

Make a hit with the home craftsman on your gift list—with one of Southern Screw's new, practical HOME-SHOP SCREW DEPTS., No. 1 or No. 2. Each contains 10 boxes of Southern's nationally advertised fasteners in the 10 most popular sizes. End your favorite craftsman's needless and time-consuming trips to the store to buy four or six screws. Give him hours more workshop time—when you give him one of these HOME-SHOP SCREW DEPARTMENTS containing over 1440 Brite Plated Southern Fasteners famous for Quality and Permanence.

**HOME-SHOP SCREW
DEPT. NO. 1.**
730 Wood Screws
432 Sheet Metal Screws
200 Stove Bolts with Nuts
ALL BRITE PLATED
1552 PIECES

WOOD SCREWS—Flat Head
1 Gross $\frac{1}{4}$ " No. 4
1 Gross $\frac{3}{8}$ " No. 5
1 Gross $\frac{1}{2}$ " No. 6
1 Gross $\frac{3}{4}$ " No. 8
1 Gross $1\frac{1}{4}$ " No. 8

SHEET METAL SCREWS
—Pan Head
1 Gross $\frac{3}{8}$ " No. 4
1 Gross $\frac{1}{2}$ " No. 6
1 Gross $\frac{3}{4}$ " No. 8

STOVE BOLTS—Round Head
100 $\frac{1}{4}$ " No. 3/16
100 $1\frac{1}{4}$ " No. 3/16

RETAIL \$9.75

Most hardware and lumber supply dealers stock Southern's HOME-SHOP SCREW DEPARTMENTS. If, however, your dealer does not have this practical and indispensable gift item, mail the coupon today and we will see that he gets it for you quickly.



Southern
SCREW COMPANY
NATIONWIDE • NORTH CAROLINA

HOME-SHOP DIVISION Southern Screw Company
P. O. Box 1360-PS11
Statesville, North Carolina

My dealer does not have HOME-SHOP SCREW DEPT. No. 1 No. 2

Dealer's Name _____ Address _____

My Name _____

Address _____

City _____ Zone _____ State _____ Date _____

Wood Screws • Machine Screws • Tapping Screws • Dowel Screws
Drive Screws • Stove Bolts • Carriage Bolts • Hanger Bolts
Warehouses: NEW YORK CHICAGO DALLAS LOS ANGELES

Sold Through Leading Wholesale Distributors

How Safe Are Our A-Power Plants?

[Continued from page 136]

runaway. Damage was confined to the reactor sites. Both accidents occurred under abnormal, experimental conditions—the one in Idaho, in a test of known risk that had required disconnecting an automatic safety control. Does this make A-power hazards seem overdrawn?

The fact is that these reactors were peanuts in power—and so, in capacity to inflict casualties and damage—compared to electric plants' mighty ones.

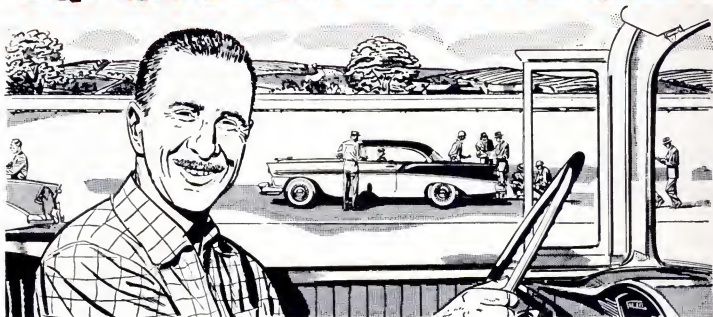
SEVEN planned U. S. A-power stations will have reactors of 236,000 to 682,000 thermal kilowatts apiece. For comparison, the famous reactors of Oak Ridge and Brookhaven rate at only 3,800 and 30,000 thermal kilowatts respectively. Thermal kilowatts, a measure of heat output, make a handy yardstick for comparing power and non-power reactors.

It takes about four thermal kilowatts to generate one electrical kilowatt. So an A-power plant yielding 50,000 kilowatts of electricity, about the smallest considered full-scale, takes a 200,000-thermal-kilowatt reactor. Only a few existing reactors, whose exact power is a military secret, are believed in the same class: our A-submarines' power plants, their land-based prototypes, and the great plutonium-making reactors at Hanford and Savannah River. It was the A-subs' prototypes that introduced "containers" for power reactors, like General Electric's 225-foot sphere around its reactor at West Milton, N.Y.

These massive gas-tight containers provide a second line of defense. Designers plan them to be strong enough to withstand the most violent imaginable happenings within: a runaway reactor's self-destruction, a blast of escaping steam, a chemical explosion, or the impact of "missiles," as the design studies call flying debris. Only if some unforeseen event breached the container, could any fission products get loose. Even then, the container would probably confine

[Continued on page 252]

"How to Think Ahead of Your Car and Save Gas Dollars!"



"Professional drivers think ahead of their cars... avoid needless stops and starts... save fuel that many drivers waste..."

Mauri Rose

One of America's top professional drivers for over 25 years, three-time Indianapolis 500-mile winner.



"Most drivers waste gas at stop lights. The smart driver goes at a steady pace, slowing down well back of a red light... avoiding the stop if possible."



"A professional driver always keeps well back of the car ahead. This way, he avoids gas-consuming 'ponic' stops... possible rear-end collisions."



"A pro never speeds over a hill or into any 'blind' situation. It's dangerous... even if you can stop in time, it's a stop and start that consumes extra gas."

You can think ahead of your car in more ways than one. Make sure you're getting all the performance you paid for... see your Rochester Carburetor specialist. He'll give your car the kind of care that only a factory-trained mechanic can. And he knows that Rochester Carburetors are precision-built for top performance on today's high-compression engines... they're rugged and reliable! They'll help you save on gas by delivering just the right mixture, at just the right time, to squeeze extra mileage out of every gallon.

Standard equipment on Cadillac, Buick, Oldsmobile, Pontiac and Chevrolet

ROCHESTER
CARBURETORS
ROCHESTER PRODUCTS DIVISION
GENERAL MOTORS CORP., ROCHESTER, N. Y.



"A stop every good driver considers necessary is at his factory-trained mechanic's for regular checks on the carburetor and vital engine parts whose condition affects performance and economy."



BEFORE-DARK PHOTO OF FOOTBALL FIELD—where the after-dark Headlamp Comparison Test photos,

Now...twice the light for



OLDER TYPE SEALED BEAM HEADLAMPS—
Student barely visible at 300 feet.



NEW GENERAL ELECTRIC *All-Weather* HEADLAMPS—
Twice as much light at 300 feet and beyond!



below, were made. Student-model stands at the marker, a full 300 feet from the car headlamps.

safer driving at night!

LOWER BEAM OF NEW G-E *All-Weather* HEADLAMPS GIVES TWICE THE LIGHT 300 FEET AHEAD ON YOUR SIDE OF THE ROAD!

Why 300 feet? Because at 300 feet, and at normal speeds, you should see objects *clearly*. Good visibility at that distance is easy with *upper* beams—yet, traffic conditions force you to rely most on the *lower* beam. That's why G. E. redesigned its headlamp lens, upped the wattage, redistributed light in the lower beam. The "Headlamp Comparison Test", pictured at left, shows that you see better at this critical seeing point with G-E *All-Weather* Headlamps—photographic proof that you can get twice the light for safer driving at night!

See Better In Fog, Rain, Snow. The special lower beam filament shield in General Electric *All-Weather* Headlamps blocks uncontrolled upward light, reduces kick-back glare, helps you see better in fog, rain and snow.

Is Accurate Aiming REALLY Important? Yes! Road shock and vibration can cause headlamps to become mis-aimed. Aimed high, headlamps glare

into the eyes of oncoming motorists. Aimed low, beams don't project far enough down the road. (If, at a point 25 feet ahead of your car, your headlamps are aimed only 3" low, you get half the light you *should have* at 300 feet!) But G-E *All-Weather* Headlamps have Aim-right Gizmos, (see arrows at right), that help dealers aim them quickly, accurately . . . even in daylight. So, for safer driving, better seeing in all weather, more accurate aiming, replace present headlamps with a pair of G-E *All-Weather* Headlamps today! General Electric Miniature Lamp Dept., Nela Park, Cleveland 12, Ohio.



Progress Is Our Most Important Product

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CLEAN YOUR CARBURETOR

Feel the difference!



For quick Winter starts clean your carburetor with GUMOUT. Eliminates stalling, bucking, loss of power.



- Whatever the season—don't let a dirty, gummed up carburetor rob your car of power... when it's so easy and inexpensive to keep it clean with GUMOUT.
- GUMOUT cleans carburetors fast—without fuss.
- Nothing to take apart. Anyone can use it.
- Have your serviceman run it through your carburetor... or just add it to your gas tank at regular intervals.
- Available at service stations, auto supply stores everywhere.

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46-page

"CARBURETOR HANDBOOK"

GUMOUT DIVISION
Pennsylvania Refining Company
2670 Lisbon Road
Cleveland 4, Ohio



How Safe Are Our A-Power Plants?

[Continued from page 248]

all but a very small percentage of them.

"Looking at it pessimistically," says Dr. W. F. Libby, AEC commissioner, "we might expect a release of one percent of the fission products in the event of a reactor failure." If the runaway reactor rates at 100,000 thermal kilowatts and has been running 100 days, this is what he says could result:

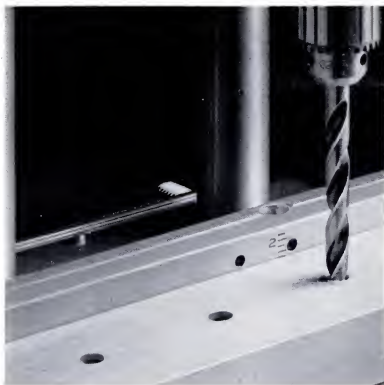
DRIFTING downwind over a region populated with 200 to 300 people to the square mile, the radioactive cloud could imperil an area of some five square miles. Several people, perhaps three to five, might suffer injury from the radioactivity of the passing cloud and its fallout. Lest the casualty list mount, all the 1,000 to 1,500 inhabitants of the danger zone would have to be evacuated. Without drastic decontamination of the stricken area, at least a year would elapse before the radioactivity died down and the refugees could return to their homes. Total damage, including contamination of farm crops over 50 square miles, could range between \$500,000 and \$2,000,000. That is the most that Dr. Libby thinks could realistically be expected to happen.

Now let's be unrealistic, he suggests. From the same runaway reactor as before, suppose that a violent accident somehow released a "worst-possible" 100 percent of the fission products into the open air instead of a mere one percent.

THAT would be a major disaster. The deluge of radioactive poison could kill 20 to 30 persons; injure 300 to 500 more; force 100,000 to 150,000 to flee their homes; lay waste the crops over an area the size of Connecticut; and cost from \$50,000,000 to \$200,000,000 in property damage alone. And all these figures would be multiplied for the more powerful reactors actually on the way.

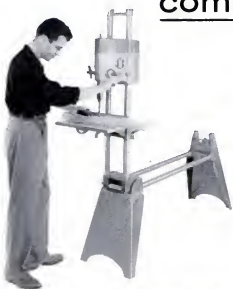
A-experts agree that the chances of this big-scale atomic-power disaster are fantastically remote. But, being sticklers

[Continued on page 254]



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NO MORE BURNING!**

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EXCLUSIVE
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SHOPSMITH® as a Vertical Drill gives you more advantages than any other drill press! Exclusive Speed-Dial control with Power-Shift gives you unmatched accuracy and safety. You dial correct drill speeds from powerful 700 rpm for large bores or metal, to 5200 rpm for plastics and small bores.

In addition, SHOPSMITH is *all* the five major power tools you need to complete any job: 9" Saw, 12" Disc Sander, 16½" Vertical Drill, 34" Lathe, and unlimited-capacity Horizontal Drill — all in one compact unit! The built-in ¾ hp motor, all belts and pulleys, are enclosed for safety. See SHOPSMITH demonstrated at leading hardware and department stores, or at any Montgomery Ward store.

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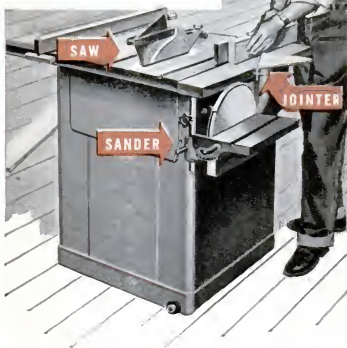
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NOVEMBER 1956 253



\$159.50 for 8" saw
(less motor, guard, and extensions)

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BELOIT, WISCONSIN

Department M, 783 N. Fourth Street

PT-12A

How Safe Are Our A-Power Plants?

[Continued from page 252]

for precise language, they won't go quite so far as to call it "impossible." That outside chance explains why some prospective operators of A-power plants insist on obtaining at least half a billion dollars of liability insurance, before a wheel turns—a record amount, of which only the government can provide the major part.

Weird hazards that could complicate a reactor runaway, or lead to other emergencies, result from the strange machines and materials of atomic power. Radioactive overheating, even in a shutdown reactor, could melt the fuel rods and loose the fission products if the cooling system failed. So designers must provide a standby cooling system—or hose connections, into which fire apparatus could pump emergency cooling water for the reactor.

Uranium metal will burn. So will sodium, the liquid-metal coolant in some of the newer reactors. Water striking sodium causes an explosion. Zirconium, a reactor structural metal, likewise can react explosively with water if it's hot and molten. Thus fire or chemical explosion could follow a reactor runaway—the chief A-power hazard of them all.

"We have been exceedingly lucky that nobody has yet been killed by a runaway reactor," says Dr. McCullough. But we can't expect such good luck, he bluntly warns, to last indefinitely.

A RUNAWAY-PROOF reactor would be a giant stride forward in A-power safety. Current efforts to develop one may be a race against tragedy.

One of the most promising designs, called the boiling-water reactor, has fuel plates immersed in water. Remove the water, and the chain reaction stops. If this reactor went out of control, designers figured, the heat would vaporize and eject the water—automatically halting the runaway.

The first small model of 1,300-1,400 thermal kilowatts, named Borax I, proved

[Continued on page 256]

PORTABLE LIGHT PLANTS

GIANT 2500 WATT PLANT
110-120 v. 60 cyc. AC. Absolutely the best made — exclusive dynamically balanced armature; heavy windings develop up to 5000 watt overload for motor starting. Skid mounted — portable. Powered by an easy starting Briggs or Wisconsin 8 HP engine—complete with all accessories; engine easily disconnected for other uses. Big outlet box, voltmeter, no wiring necessary. Ample current for all purposes. Factory warranty. (Item 31) 210 lbs. Reg. price \$539.50. Special... **\$299.50**
Same plant with electric self starter... **\$359.50**
Generator only and control box... **\$149.50**
DUAL VOLTAGE 110-220 available on any of above models for \$28.00 additional.

POWER-FLO 3500 WATT
115-230 v. 60 cyc. AC. A rugged power plant for heavy duty use. Duplex power distribution provides both 115 and 230 v. output at the same time desired. Powered by a big 8 HP Wisconsin engine with triple belt drive. Has built-in overload protection. A dependable plant for either standby or regular service. Equipped with electric self-starter. (Can also be started by rope and plug-in outlet box. (Item 198) Wt. 310 lbs. Factory price... **\$439.50**
GENERATOR ONLY belt driven... **\$239.50**



PORTABLE BOOM HOIST

Here is a big 3000 to 10,000 lb. capacity boom hoist at a fraction of the usual cost. It's Gov't surplus — that can pay for itself on one job! Can be mounted as a stationary crane in yards or used as a mobile crane on trucks for use as a wrecker or mobile crane. Massive telescoping boom is quickly extended from 10 to 20 ft. with a built-in winch. Ideal for erecting buildings, transferring materials, loading machinery, unloading lift cars, lifting boats from water, laying out pipe, etc. (Item 201) Wt. 650 lbs. Orig. cost over \$350. Special F.O.B. Shelby, Ohio... **\$89.50**

GIANT METAL SHEARS

"PEXTO"
Nine inch cutting blade made of special high carbon alloy steel, perfectly aligned and ground. Easily cuts steel plate up to 12 gauge or 1/2" thick. Overall length 30". 23 lbs. (Item 156) Regular \$49.50. While they last... **\$14.95**

Double Acting Hydraulic Cylinder

A powerful cylinder mfr'd. by Massey Harris which develops both a pushing and a pulling action. With push or pull pressure. Cylinder is 3 3/8" O.D. with 6 1/2" stroke—standard heavy duty cylinders on both ends. Has standard 1/2" pipe thread openings. Can be used for lifting buckets or blades, raising or lowering implements, hydraulic presses, etc. Can also be used as an air cylinder. 1 1/2" air cylinder, 100 lbs. Reg. price \$149.50. Special... **\$14.95**

JET FLOW BLOWER

Tremendous air movement (1800 CFM) and quiet operation make this double inlet 100" turbine blower unexcelled for cooling, drying and air conditioning. Ideal for attic or barn ventilation, converting gravity heating to forced air; spray booth exhaust, raising or lowering implements, hydraulic presses, etc. Can also be used as an air cylinder. 1 1/2" air cylinder, 100 lbs. Reg. price \$149.50. Special... **\$14.95**

HEAVY DUTY 1/4 HP MOTOR FOR ABOVE \$17.95

Send check or M.O. Prices f.o.b. Factory. 10 day money back guarantee. SEND 10c for...

MASTER MECHANIC MFG. CO.,

Get the best at **MASTER MECHANIC'S** bedrock factory prices!

(Item 24)

700 WATT PLANT

PUSH BUTTON START

115 v. 60 cyc. AC Powered by a rugged 2 1/2 HP. easy starting Briggs engine. No wiring necessary: just plug in and operate. Plenty of current for all oil burner, brooder, emergency lights, etc. which require up to 700 watts. Ideal for all industrial use. Complete with voltmeter and built-in winding to 220 v. v. 60 cyc. AC. A powerful plant, easily fits in car trunk. Be prepared if storm knocks out power lines. (Item 24) Wt. 210 lbs. Reg. price \$539.50. Special... **\$143.50**
1200 Watt Plant (Item 45) same as Item 14 but larger generator and engine... **\$199.50**
We make every type and size light plants. —Write, giving us your requirements!

EXTENSION CORD

Heavy duty and very flexible. Neoprene 14-24 cable. 20 year quality. Wt. 12 lbs. (Item 185) 100 ft. Complete with rubber plug and outlet. A terrific buy at only **\$8.95**

No. 10-2 POWER CABLE. Heavy duty, very flexible, rubber covered, 50 ft. with male and female fittings. Wt. 9 lbs. (Item 502a) **\$10.45**
No. 12-2 POWER CABLE. Heavy duty, very flexible, rubber covered, 50 ft. with male and female fittings. Wt. 10 lbs. (Item 502b) **\$11.95**

No. 12-2 POWER CABLE. Heavy duty, very flexible, rubber covered, 50 ft. with male and female fittings. Wt. 10 lbs. (Item 502b) **\$11.95**

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No. 12-2 POWER CABLE. Heavy duty, very flexible, rubber covered, 50 ft. with male and female fittings. Wt. 10 lbs. (Item 502b) **\$11.95**

LESS THAN WHOLESALE

1500 WATT PLANT
115v. 60 cyc. AC Push Button Start. Powered by a 3 1/2 HP. Clinton engine. Comes with 100' of 1/2" cable with easy portability. Provides emergency power for operating any oil burner, pump, freer, television, etc. (Item 21) Wt. 220 lbs. Reg. price \$475.00. Factory price... **\$239.50**

1750 Watt Plant Powered by 4.5 HP Briggs engine. Comes with 100' of 1/2" cable with easy portability. Provides emergency power for operating any oil burner, pump, freer, television, etc. (Item 21) Wt. 220 lbs. Reg. price \$475.00. Factory price... **\$279.50**

MASTER-LITE 2500 Watt Plant
110/120 v. 60 cyc. AC. A powerful plant, ruggedly constructed and designed for easy portability. Can be started by rope or built-in winding button start. (Item 21) Wt. 220 lbs. Reg. price \$475.00. Factory price... **\$279.50**

3500 Watt Plant Push Button Start (Item 23) 115 v. 60 cyc. AC. Similar to above, but larger size. Comes with 100' of 1/2" cable with easy portability. Can be started by rope or built-in winding button start. (Item 23) Wt. 220 lbs. Reg. price \$475.00. Factory price... **\$379.50**

DUAL VOLTAGE 110/220 for Item 21 or 23 —\$30 additional.

DIESEL LIGHT PLANT
(Item 1660) Diesel Master—11-12 kw. 110/220 v. AC single or 3 phase, 1800 rpm direct connected. Electric self starting. Engine—permanently mounted power where continuous low-cost power is important. Wt. 1350 lbs. Reg. list \$2600.00. Factory Price... **\$1895.00**

HEATING & VENTILATING FAN
(Item 10) Easily installed in furnace pipes. Forces even heat to all rooms. Over range resistor. Kitchen range. Powerful, continuous duty motor. 110-120V. AC. 1/2" wall or ceiling to ventilate any room. (Item 10) Wt. 1400 to 600 CFM. 8" Pipe, wt. 5 lb. \$6.85
10" Pipe, wt. 7 lb. \$8.85
12" Pipe, wt. 9 lb. \$10.85
14" Pipe, wt. 11 lb. \$12.85
16" Pipe, wt. 13 lb. \$14.85
18" Pipe, wt. 15 lb. \$16.85
20" Pipe, wt. 17 lb. \$18.85
22" Pipe, wt. 19 lb. \$20.85
24" Pipe, wt. 21 lb. \$22.85
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626" Pipe, wt. 623 lb. \$624.85
628" Pipe, wt. 625 lb. \$626.85
630" Pipe, wt. 627 lb. \$6

How Safe Are Our A-Power Plants?

(Continued from page 254)

the idea sound. Argonne National Laboratory experimenters tried in vain, 200 times, to make it run away. Borax I simply burped, spewed a boiling-water geyser 30 feet high, and shut itself off.

Only by a very unfair trick, shooting a control rod suddenly out of the reactor with a spring, did they manage at last to outwit Borax I's protective reflexes. There was a flash of light, a sharp detonation, and an 80-foot-high column of dark-gray smoke enveloped the reactor. When it cleared, observers saw that the superstructure had been carried away. Most fragments of wreckage fell within 200 feet of the reactor and there was no appreciable fallout beyond a few hundred feet. You could make this reactor run away if you were determined to, the trials showed, but not unintentionally. Bigger models have followed.

Largest boiling-water reactor to date is one of a modest 15,000 thermal kilowatts, but projected ones range up to a

full-scale 682,000-thermal-kilowatt version, with which Commonwealth Edison plans to generate 180,000 kilowatts of electricity at Dresden, Ill., by 1960.

RIVAL "runaway-proof" types may emerge from an intensive new AEC program of reactor-safety tests upon expendable, remote-controlled reactors of a variety of designs. Some of the trials are now under way at the National Reactor Test Station in Idaho, where the test reactors occupy isolated pits that will limit damage in case of a runaway, and will simply be abandoned if heavily contaminated. On trial, too, is a fast-acting "fuse" that would stop a runaway by squirting a neutron-absorbing gas, under pressure, into a reactor. Explosive charges will test the staunchness of different kinds of containers. Through experiments like these, researchers hope to reduce the hazards of A-power to the vanishing point.

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Both Built to Last a Lifetime...

NEW

**Tubular
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**Solid Forged Head Fused
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Strongest where Strain
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**Cushion Grip of
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Unbreakable Hammers and Hatchets . . . ESTWING MFG. CO., Rockford, Ill.**

Kean Kutt says...



**SHARK
BRAND**

**SWEDISH CHISELS
MAKE HARD JOBS
EASY because of**

SWEDISH CHARCOAL STEEL

The steel used in Shark Brand Chisels contains fewer impurities than steel made with coal or coke and when it is properly annealed and tempered becomes tough but not brittle and therefore they hold their edge much, much longer.



...but there's more to why Shark Brand Chisels outlast and outperform ordinary chisels. Ask for them at your hardware dealer... write for new free booklet Dept. PS

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Life-Like!*



GIANT PASTE-ON, CUT-OUT XMAS LAWN DECORATIONS

New way to say "Merry Christmas" to the entire neighborhood. Bright colorful Christmas figures for beautiful king-size lawn, roof and window decorations. Printed in sparkling full color on heavy paper. All you do is paste pattern on fir plywood and cut out with saw. It's easy. Anyone can do it. Order today!

Jolly 6-Foot Santa
(plus 24" Xmas Wreath cut-out) **50c** each

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(plus 24" Xmas Candle cut-out) **50c** pair

Three 4-Foot Choir Boys
(plus Xmas Music Scroll cut-out) **50c** set

Shipped prepaid in heavy cardboard tubes. Offer good USA only. Sorry, no C.O.D.

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HEAVY
DUTY
SANDER**

Outsands, outlasts others. Exclusive "no jump" Multi-Motion action. Get this modern "king of Portables."

\$39.95

• That's because both sanders are super-powered with the famous Syncro Reciprocating Motor—today's greatest research triumph! This unique, direct-drive motor has no belt, cam, gears; no rotating parts to wear out. It is guaranteed against burn-out during ownership. Syncros are so easy to use, so powerful, durable! Why push and "fight" old-fashioned portable sanders when Syncro Multi-Motion sanding—with genuine Syncro Reciprocating Motor—is yours so economically? See at tool dealers—write for Catalog, Reciprocating Motor data!



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WORLD'S LARGEST RECIPROCATING MOTOR MAKERS

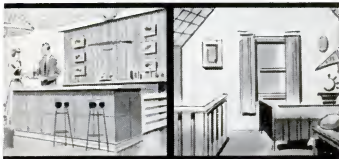


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faster -
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save up to **50%**

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**UPSON
BOARDS**



Making a fun room is easy and inexpensive with Upson Boards.

From unfinished attic to beautiful extra room with crackproof $\frac{1}{4}$ " or $\frac{3}{8}$ " Upson Boards.

There is no end to the fine, beautiful jobs you can do with Upson Wall Board. Here are just a few:

Add-A-Room • Attics • Basement Walls and Ceilings • Built-ins • Cabinets • Chests • Closets • Cut-out Toys • Doll House • Door Panels • Drawer Bottoms • Garage Walls and Ceilings • Model Train Tables • Play-Store • Recreation Room • Storage Walls • Toy Chest • Wardrobes

Light and strong, Upson saws cleanly. Sands smoothly. Paints beautifully. Assures you of a quality finished job for less money. You'll be amazed with the results. Ask your lumber dealer about Upson Board's large variety of thicknesses and sizes. Won't split, splinter or crack. From $\frac{1}{8}$ " $\frac{3}{16}$ " $\frac{1}{4}$ " $\frac{3}{8}$ " to waterproofed, super-strong $\frac{3}{4}$ " for outside use. Pebbled, smooth and striated surfaces. Sizes from 4' x 6' to huge 8' x 20'. Saves up to 50%. Costs 50% less than plywood of same thickness. To be sure of best results, always ask your lumber dealer for Upson Board by name.

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Fits any 8" power saw. Faced with Aluminum Oxide Abrasive. One side coarse grit. Other side fine. Use on wood or metal. Order now. Upson Co., 4511 Union Point, Lockport, N. Y. Sent postpaid.

What's New in the 1957 Chrysler Family

(Continued from page 123)

been increased from 354 cu. in. to a whopping 392 cu. in. This big power plant puts out 325 horsepower, with a bore and stroke of 4 by 3.9 inches. Intake valves have been increased to two inches in diameter; compression is 9.25:1.

Imperial bodies have a lower roof line nestling between higher upswept rear fenders. Side windows are curved inward at the top giving the body symmetry and roundness. The rear deck is lower, cutting into trunk space but adding rakishness to rear-end design. Imperial's famous circled taillights are now worked into the rear fender.

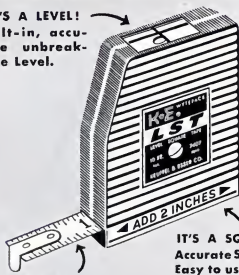
Chryslers now come in three series: New Yorker, Saratoga, and Windsor. The New Yorker will be powered by the big 392-inch, 325-hp. Imperial engine. The Saratoga and Windsor will have 354-cu.-in. engines with high-dome pistons that bring compression up to 9.25:1. Intake valves are upped to 1.94 inches in diameter. The 285-hp. Windsor has a two-throat carburetor as stock equipment while the New Yorker and 295-hp. Saratoga have four-throat carbs. All series will be equipped with the TorqueFlite automatic transmissions.

DeSoto is offered in three series: FireFlite, FireDome, and FireSweep. The FireFlite and FireDome series, which are one inch longer than last year, are powered by V-8 engines of 340 cu. in. and 9.25:1 compression ratio. The FireSweep has a 245-hp. engine (260-hp. on the four-barrel-carburetor model) and 8.5:1 compression ratio. The three-speed TorqueFlite transmission is standard on the FireFlite (295-hp.), optional on the FireDome (270-hp.) and FireSweep.

Dodge. The dramatically styled 1957 Dodge has only one V-8 power plant, with a bore and stroke of 3.68 by 3.80. Displacement is 325 cu. in. and the compression ratio 8.5:1. Horsepowers range from 245 to 310. Intake valves are $\frac{1}{8}$ inch larger in diameter, which of course improves breathing and power. The sturdy old six is still available, its compression kicked up to a sprightly 8:1. **END**

it's NEW! it's ALL IN ONE LEVEL · SQUARE · TAPE

IT'S A LEVEL!
Built-in, accurate unbreakable Level.



IT'S A TAPE!
10 ft., replaceable WYTEFACE® Tape.

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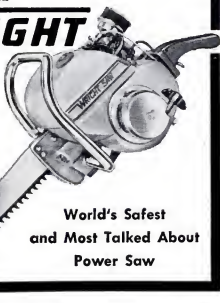
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This is the power saw you're reading about . . . cuts wood like a hot wire hissing through an icicle

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Power Saw**

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\$179.⁵⁰**

Including Blade
f.o.b. Sheboygan, Wisc.

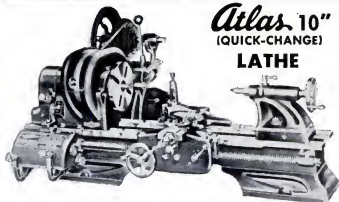
Write for big illustrated folder showing dozens of uses around homes and farms:

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Dealerships Available

Feature for Feature
Atlas
is your best buy!

Atlas 10"
(QUICK-CHANGE)
LATHE

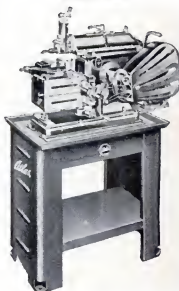


For development work, home repairs, a hobby or commercial shop—no other lathe in the low-cost field compares with this Atlas 10" lathe. Timken tapered roller bearings, precision-ground bed, 16 spindle speeds, instant selection of 54 threads or feeds, complete V-belt drive and power cross and longitudinal feeds are but a few of the many features that make it the most accurate and efficient lathe in its class. Send for the latest catalog today!

Atlas 7" **SHAPER**

Atlas is the most practical 7" shaper . . . and the greatest value. It handles the complete range of shaping operations—quickly, easily and accurately. It is the only 7" shaper that is Timken bearing equipped . . . the only 7" shaper with roller bearings on countershaft spindle, cast iron bull gear with 1" face, and outside stroke adjustment. Exceptionally heavy and ruggedly built. Has ground ways, 4 speeds, 5 reversible automatic power cross feeds. Send for latest catalog.

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NOVEMBER 1956 **259**



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The World's Fastest Gun

[Continued from page 140]

that could be adapted to many industrial or manufacturing jobs that require a fast rotating mechanism.

This rotating multi-barrel feature gives the gun advantages besides faster firing and cooler barrels. The latter, in fact, helps prevent "cook-offs"—the unwanted firing by barrel heat of a round of ammunition left in the chamber after a burst.

Accidental firing, under any conditions, is prevented by a positive mechanism. When this clearing device is on, a shell cannot move forward into firing position, but is diverted directly to the eject position.

The new Gatling also neatly disposes of the dud problem. Since it does not

The trouble with some people who rise to the occasion is they don't know when to sit down.

—THE SIDEWALK SUPERINTENDENT

depend on its own energy to fire, it doesn't know or care whether it fires or not. A dud shell goes through the operational cycle and is ejected in the same way as an exploded cartridge case.

The weight of the Vulcan has been brought down to 300 pounds, but it still weighs about 2 1/2 times as much as a standard, automatic aircraft machine gun. Its astounding rate of fire, on the other hand, is perhaps 10 times greater.

The Air Force's newly unveiled Lockheed F-104 Starfighter, which was reportedly designed for a speed of 1,500 miles an hour, has a bulge on one side of the fuselage that indicates it may be armed with the new gun. The still secret Republic F-105 fighter-bomber is almost certain to have the Vulcan.

It is true that these jets won't be able to shoot very long with a gun that throws more than a ton of metal a minute. The ammunition weight would be too great. But short bursts are all they will need.

As one Army Ordnance officer put it: "With the Vulcan even a short burst is a barracks bag full of bullets."

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These are a snap to build with Western Pine woods.

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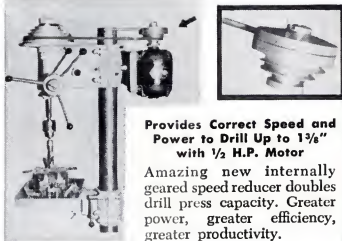
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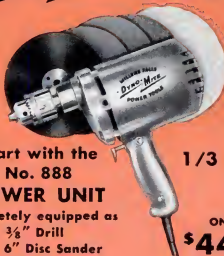
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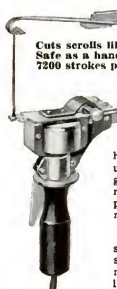
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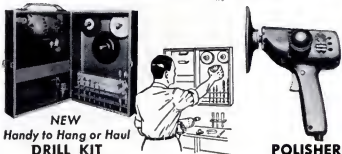
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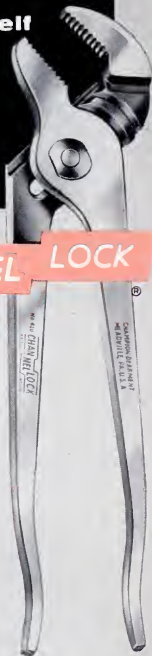
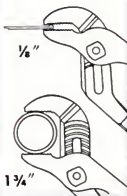
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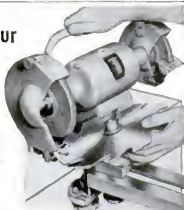
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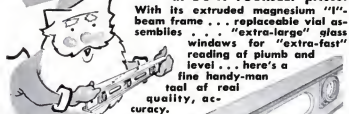


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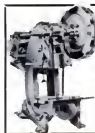
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Illustr. Model \$609

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WEATHER *Live Rubber* STRIPPING

Get a warmer, more comfortable home AND save up to 20% on fuel costs with INNER-SEAL weather stripping on your doors, windows, storm windows!

INNER-SEAL is waterproof, tough, flexible; easy to install; lasts for years. Spring steel wire molded in neoprene-coated sponge rubber assures tight seal. Has Good Housekeeping guarantee.

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Be an expert, use
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**NOW—THE QUICK-WAY TO SHARPEN
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NEW

Model
PG-12
Complete
No
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to buy.
\$16.50
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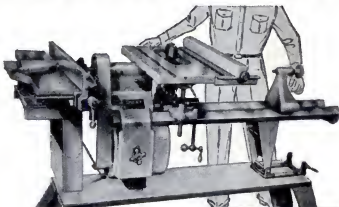


Model PG-12 sharpens, joints, gums, and retoots all cross cut, rip, combination, miter, and planer blades up to 12" in diameter. Two precision index plates give versatile, accurate sharpening. Guarantees precise spacing of teeth. New safety rest prevents tilting and gouging of blade. Save time and money. Special \$3.00 grinding wheel also included for use on

your own power table. Fits regular or radial swing tables. Order today. Send check, cash, or money order. We pay postage. FREE Booklet—How to Sharpen Circular Saws.

QUICK-WAY SAW CO., 134 Tompkins St., Cortland, N.Y.

**LOOK! All New - All Precision - All Deluxe
SUPERSHOP MODEL X**



**WE PAY ALL
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YOUR FREE
HOME TRIAL**

8" SAW

**ONLY
\$139.50
EASY
PAY
PLAN**

Never before have you seen so much deluxe, precision-built power tool workshop at any price! Designed for the man who wants the best. Massive cast and precision-machined headstock, self-centering inverted "V" bedways (like precision metal lathes), exclusive non-friction speed changer, extra-large cast and precision-ground saw table. 100% ball bearing, lifetime-lubricated. You save by ordering direct from factory. You are invited to test Supershop Model X in your home FREE. Mail coupon or postcard for FREE brochures, photos, details, specifications, accessory list — and amazing freight prepaid FREE HOME TRIAL PLAN. All free.

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Vert. Drill Press



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5" Sander



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5" Grinder

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A "GIFTED" GIFT BANISHES HAND- SANDING FOREVER

Save up to 80%
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Model 300D
5" dia., 3/4" wide
Complete with Cartridge

Like a dozen hands stroking the surface every second, Sand-O-Flex Sanding Wheel is the perfect contour sander. Firm, cushioning banks of bristles back up the projecting strips of abrasive cloth, forcing them into, around, over or under the work. Fresh abrasive strip unwinds from cartridge as ends are worn. Refill cartridges readily available, choice of coarse, medium or fine grits. No waste—costs no more per job than sheet sandpaper. Light cast body, 6 brushes. Fits 1/2", 3/8" shaft. Adaptor for 1/4" elec. drill 75c.

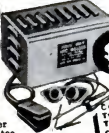
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Complete with
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accessories... to
handle all metal-
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Acclaimed by thousands of Homeowners, Mechanics and Hobbyists as the welder of 1001 uses. Easily operated from properly wired 110 volt AC or DC line. The ideal gift with a life-long use. Order today on 10-day money-back guarantee.

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BUILD YOUR OWN POWER TOOLS-

With **GIL-BILT PARTS-PLAN KITS**



10" TILT/ARBOR SAW

Sturdy wood, steel, and aluminum construction. NEW DEPARTURE ball bearings. Capacity and performance of floor saws selling for \$150.00 and up. Plans, all metal parts in kit with 10" comb. blade \$29.90, less blade \$22.95. F.O.B. St. Louis, Mo. Detail PLANS-PATTERNS only \$1.00 postpaid.

12-IN. BAND SAW

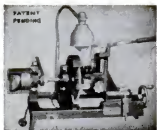
Ball bearing drive, rigid cast aluminum wheels, rubber tires. Handles stock up to 6 inches thick. Cuts to center of 24" circle. 18 x 18 inch tilt table. Capacity and performance of band saws selling for \$80 and up. Plans and all metal parts in kit with 1/4" blade \$23.95. Detail PLANS-PATTERNS only \$1.00 postpaid.

For shipments up to 400 units, add 5%; over 400 add 10%. Amount in excess of actual postage will be refunded.

Also Build-it-yourself 18" Band Saw, 6" Belt Sander, Shaper, 8" Tilt-Table Saw. Simplified plans, built easily with hand tools only. Advertised and sold for 8 years, over 30,000 units in use. Money back guarantee. **FREE CATALOG.**

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St. Louis 21, Missouri



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SHARPEN DULL PIPE WRENCHES

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"GUM" CIRCULAR SAWS

Also MOTOR DRIVEN ROTARY HOME

Write for Information

J. C. MOORE INDUSTRIES

Box 5276, Fredonia, Pa.

SOMETHING NEW!!

High Quality Walnut or Honduras Mahogany furniture plywood in convenient sizes. Same quality as used by Old Craftsmen of Grand Rapids. Sanded Polish—Ready for use: 5 ply 1/4" or 3/8" thickness. Sizes 18" x 36"; 24" x 48"; 30" x 60". Price per ft: 1/4"—45c; 3/8"—75c; F.O.B. Columbia. Special Orders invited—Minimum of 50 Pcs. Maximum Size up to 36" x 72"—low factory prices. For immediate delivery send check or M.O.—no C.O.D. Satisfaction Guaranteed. **CAROLINA PLYWOOD CO., 519 Superior St., Columbia, S. C.**

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INSIST ON EAGLE FOLDING RULES

COIL SPRING JOINTS

GUARANTEED AGAINST JOINT FAILURE FOREVER

EAGLE RULE MFG. CORP. N.Y. 59, N.Y.

It's QUICKER ... Works SLICKER with



Put a "handle" on work when using power tools! Holds finest work with ease—and SAFETY!

Does More Jobs Easier
Than Any Other Tool
Made!



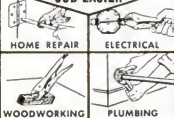
No. 10W, 10"
\$2.60

A squeeze of the hand locks jaws onto work with ton-pressure! Quickly adjusts for use as All-Purpose Wrench, Super-Pliers, Clamp, Wire Cutter. 7" and 10" cutter optional. \$1.85 to \$2.60 at your dealer.

Made By **PETERSEN MFG. CO., Dept. M-11, DeWitt, Nebr.**

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AMAZING CRYSTAL RADIO

Here is a COMPLETE SELF POWERED RADIO RECEIVER that picks up STANDARD BROADCAST STATIONS without using batteries or electricity! Just plug in the headset, antenna and ground wires and tune in your favorite program. You'll be amazed at the STRONG, CLEAR SIGNAL. Nothing to assemble - nothing to buy. Has a 100KC tuning range. Comes complete with receiver, sufficient antenna and ground wires PLUS A HEADSET with two 2000 ohm ear-phones. Ideal for that personal or private radio.



Only 3.95

Special 12 Pc. SPORTSMAN'S KNIFE

NEW LOW PRICE - Same high quality. Over 20,000 sold last year - because of this large volume we are able to greatly reduce our price to you - SAVE!

IDEAL GIFT FOR FATHER, SON or FRIEND
ELIMINATE 12 ITEMS FROM YOUR PACK

Here is the Perfect, Combination Knife Tool for every Outdoor Sportsman. Hunter, Camp, Fisherman, Boy Scout, Ranger, Rancher, etc. Think of it! 11, Fine quality Steel Tools, precision made to fold easily into the heavy bone covered body. In one neat, compact unit you have: (1) a regular knife, (2) a fork, (3) a spoon, (4) a draw knife, (5) a bone saw and fish scaler, (6) a corkscrew, (7) a can and bottle opener, (8) a cork screw, (9) a saw punch, (10) a screwdriver and (11) a metal file. All this PLUS a genuine leather, belt holster.



Complete with Genuine Leather Holster!



SPECIAL PARATROOP
FOLDING MACHETE
AND LEATHER HOLSTER

The latest design with a new blade shape and tapered beveled edge that is honed to cut quicker and deeper. Blade is finest, blued, nickel alloy steel. The handle is heavy bakelite with diamond point knurl to assure positive, nonslip grip. Blade folds into handle and special steel guard like a giant pocket-knife giving absolute protection to the user. When open a positive safety lock holds the blade rigidly in place. A cowhide wrist thong in handle prevents losing knife. Ideal for chopping, cutting, etc. Overall 17", blade 11".

2.89
WITHOUT HOLSTER
15¢ VALUE

FIGHTING KNIFE



NAVY KNIFE 2.98
LEATHER HOLSTER 1.99

Dagger design with laminated leather handle. Blade is 6-1/2" long, hollow-ground on the cutting edge and double-edged for 3-1/2" at the point. Ideal skinning or hunting knife. Comes with a genuine leather belt holster. Overall length 11". Order while we can supply.



18" HYDROPLANE

Made of special pre-formed hardwood. Single-step design. Fast and easy construction. Kit includes all parts plus metal frame, plastic windshield. Designed to use miniature outboard motor below.

OUTBOARD MOTOR runs on two flashlight batteries. Enough power to drive boats up to 18" long. Tilts-level mount.

FREE FOLDER ON MODEL PLANES models plus accessories and supplies. Write for yours today! SAVE!

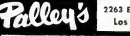
2000 WATT POWER PLANT

Ideal for use on Farm, in Camp, Cabin, Mine or as Standby Power.

Delivers 20V, DC 70 amps. Rated at 2000 watts. Operated by a single cyl. alternator.

cycle, gas engine. Turns 2600 RPM. Comes with voltage regulator and belt-motor. Size: 21 1/2" x 18 1/2" x 18 1/2". Tremendous Buy!

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Send for your copy today! Each one is full of typical Palley's Bargains at great savings. Please give folder number.

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3400 RPM - 1/2 HP POWER SAW



RIPS - CROSSCUTS CUTS A FINISHED 2x4 LIKE A KNIFE THROUGH BUTTER

COMPARES TO
SAWS SELLING
UP TO \$40.50

1998 Complete with 5-1/2" Blade

A rugged, professional type, adjustable saw. Will cut any angle from 0 to 45°. Has an adjustable (0 to 6") rip fence. Safety-trigger switch on handle. Full 1/2 HP Universal AC DC, 110-120 Volt, 60 cycle motor. Weighs only 8 1/2 lbs. Thousands already sold. Your satisfaction guaranteed.

EXTRA SAW BLADES - Available in 6" or 8" Crosscut or Combination. Please Specify 235A



NEW POWER SAW BENCH TABLE

This sturdy, precision made bench-saw table converts our famous power saw (above) to a handy bench-saw. Permits angle and bevel cuts, rip, crosscut & comes with rip fence and mitre guide. 14" x 16" table, 6" high.

NEW
ONLY
9.95



1/4" ELECTRIC DRILL

\$17.50 VALUE

A tremendous Value. Has heat treated, high speed gears - self-lubricating bronze bearings and a genuine Jacobs type Chuck. Fully air cooled. Has a Safety-trigger switch. A tool of many uses - drilling, grinding, polishing, as a drill-press, etc. Under stock complete

SPECIAL DRILL STAND

For 1/4" electric drills. Sturdy built with drill bracket mounted on a steel column. Gives 4 to 1 leverage at the handle. Feed wheel is 3/4" diameter. Line of drill to column is 4". A \$14.95 Value - Special - ONLY

9.95



DRILL-DRIVEN BAND SAW

NEW
17.95
VAL.

Easily driven by the 1/4" electric drill shown above and can be adapted to any other similar drill. Saws straight lines or curves. Cuts corners, cabinets, toys, etc. Full 10" throat, cuts to the center of 20" board. Has a tilt table, adjustable bearings, adjustable high impact, phenolic pulleys, 3/16" saw steel blade, die-cast aluminum housing & many other fine features. Height - 16 1/2".

12.88



18 PIECE - 2 IN 1 DRILL AND POLISHER

NEW
24.95
VALUE

Designed for polishing and buffing but works equally well on 1/4" drills. Ideal for use on cars, furniture, shoes, etc. as polisher or buffer or becomes a sander, rust remover, grinder, abrasive cut and power drill by simply changing accessories. A long, three piece handle makes it excellent for cleaning and working floors. Can be adapted to drive band saw above. Comes complete with 1/4" Jacobs chuck, auxiliary handle, extension handle, polishing bonnet, rubber & sanding discs, spindle adapter and motor. Very handy around the home or shop.

27.00

VALUE 19.95



SAVE
50%

GENUINE SELECT PHILIPPINE MAHOGANY PLYWOOD

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For Fine CABINET WORK, FURNITURE, Paneling DENS, OFFICES, HOTELS, etc.

Our prices are LESS THAN DOMESTIC PLYWOOD AT WHOLESALE. This selected LUAN MAHOGANY meets the most rigid specifications. It is WEATHER AND WATER RESISTANT. You'll be amazed at the beauty of this fine wood. Its rich golden elegance will thrill you. Rarely cut for beauty of grain. Both sides sanded and ready to use. Bonded with finest resin adhesive. Face side jointed.

FREE SAMPLE ON REQUEST

Available in three thicknesses - 3mm (approx. 1/8"), 1mm and 1/4". ALL orders shipped by special truck for lowest rates. No order accepted for less than 100 lbs. (equal to 4) 1/4" sheets, (6) 1mm sheets or (8) 3mm.

3MM (1/8") x 36" x 6 FT.
\$5.00 VALUE
MINIMUM ORDER 8 SHEETS

1/4" x 4 FT. x 8 FT.
9.50 VAL.
MIN. ORDER 4 SHEETS

179 PER SHEET

449 PER SHEET



SAVE 50% ON TRANSLUCENT FIBERGLAS PANELS

Ideal for the home or office and in new construction. Finest quality in many widths and lengths. A variety of colors to suit every taste. Send for a FREE SAMPLE and booklet, worth \$5.00. No fee.

ONLY
49¢
SQ. FT.

Palley's

226 E. VERNON AVE., DEPT. PS-11
Los Angeles 58, California

The "Tin Goose" Is Flying Back

[Continued from page 133]

the choppy water 500 feet below. Nobody ever fished the engine out to see just what went wrong. Maybe the crankshaft broke. Anyway, the pilot heeled the old bird about on her two good beaters and headed back to the field and got the other Ford. All 14 of his passengers were aboard when he took off again.

The Hayden Corporation's 1957 version of the 1925 Tin Goose will be called the Stout Bushmaster, after the late William B. Stout, who designed the Ford model. Bigger and faster than the Ford, it will be powered by a trio of 450-hp. Pratt & Whitney engines and will cruise at 125 with a gross load of 12,500 pounds. Its cabin and fuselage will be 18 inches wider, increasing cargo space by 180 cubic feet. The new model will carry 21 passengers.

The Bushmaster will cost about \$100,000; the Ford sold for \$60,000 when

first produced and was going for \$37,500 by 1932.

The Bushmaster will have trim tabs for both rudder and elevator, and toe brake controls. Overall modernization

.....

There are two kinds of antique furniture—the kind that is too uncomfortable to sit on, and the kind that's too comfortable to get up out of.

—THE SIDEWALK SUPERINTENDENT

.....

will include internal control cables, hydraulic landing-gear struts, and a full-swivel tail wheel.

But the jet-age trimotor will be no robot-guided luxury liner. Hayden says it will come off the production line as a "rugged, basic and reliable airplane containing only the instrumentation necessary for contact flying in underdeveloped regions."

END



NEXT MONTH:

All About the New TV Sets

What's with TV sets this year? You'll get the facts and figures in the December **POPULAR SCIENCE**. There are more, cheaper color receivers—but is '57 the year for color? The glamorous portables are catching everyone's eye—but how do they stack up against the old reliable 21-incher? And plenty's happening to that old reliable as automatic manufacturing and new circuits revamp its insides.

This special television feature will give you the whole story: what's behind the glowing screen, why one circuit works better than another, plus specifications, set by set, for the major makes. For the complete factual report on television-1957, don't miss the December **POPULAR SCIENCE**.



Belt Driven A. C. GENERATORS

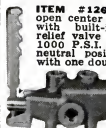


ITEM #1010

Ideal for powering electric tools, oil burner, refrigerator, lights, or other appliances requiring up to 1000 watts of power. **1000 WATTS.** 115 Volts, 60 cycles A.C. 3600 R.P.M. Compact, self-regulating generator with V Belt pulley and double outlet receptacle. Rotation counterclockwise. May be driven by tractor or auxiliary gasoline engine. Requires 2 1/2 HP minimum. Dimensions: 10" long x 8" high x 6" wide. Shipping wt. 27 lbs. F.O.B. Chicago..... **79.50**

Model 700—750 WATTS
(Same as above) **59.50**
2000 Watt Generator..... 149.50

GROBAN FOUR-WAY OPEN CENTER HYDRAULIC CONTROL VALVE



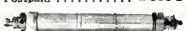
ITEM #126—Four-way open center control valve, with built-in adjustable relief valve factory set at 1000 P.S.I. Spring loaded neutral position. For use with one double acting cylinder. In neutral position, oil is locked and pump unloaded. Can be used as single inlet or mounted in series. Has 3/4" pipe thread inlet and outlet. 1/2" pipe thread cylinder ports. Finger grip handle. Ship. wt. 10 1/2 lbs.
AN OUTSTANDING BUY!
F.O.B. Chicago **21.50**

DOUBLE ACTION HYDRAULIC CYLINDERS



ITEM #31C—3 1/2" bore, 1 1/2" stroke. Alloy steel cylinder wall. Micro-finished and all steel. 1 1/2" diameter piston rod. 18 1/2" overall length closed. Clevis mounting at base and shaft. Will lift 9625 lbs. with 1000 PSI Pump Pressure. Uses 3/4" tubing fittings. (Fittings to pipe thread: two 3/8" NPT or 3/8" S. A \$102.00 value. Shipping weight 11 lbs. F.O.B. Chicago... **25.00**

ITEM #16-C—1 1/2" bore, 26" stroke. Will lift 1760 lbs. with 1000 lbs. pump pressure. Great for hay loaders, etc. 1" stainless steel piston rod. Postpaid **16.95**



ITEM #103—HYDRAULIC CYLINDER, double acting, 2 1/2" bore, 17" stroke. Clevis mounting. Maximum lift capacity 4900 lbs. with 1000 PSI pressure applied. Shaft diameter 1 1/4". 3/4" tubing thread ports. (Adaptors to pipe thread, 3/8" each.) Overall length closed, 28". Shipping Weight, 11 lbs. F.O.B. Chicago..... **23.50**

GROBAN BARGAINS!

SURPLUS & NEWLY MANUFACTURED SPECIALS



FACTORY-TO-YOU-VALUE PORTABLE ELECTRIC LIGHT PLANTS

POWER TO OPERATE:

• Electric Saw, Electric Drills, Pipe Bender.

• Refrigerator, Deep Freezer, Incubator.

• Water Pump, Radio, Lights, Air-conditioner.

BRAND NEW 1957 COMPACT—FITS IN THE TRUNK OF YOUR CAR

1000 WATTS OUTPUT, continuous duty. 115 Volts A.C. 60 cycles, 9 amps. Powered by husky, easy starting Clinton engine. Engine and generator operate at 3600 R.P.M. for maximum efficiency at minimum weight. Both units are mounted on steel base, with heavy sheet metal belt guard. Generator is self regulating, and is equipped with outlet box containing fuse and 2 A.C. convenience receptacles. Cost only 5c an hour to operate. Dimensions: Length 20 1/2", Width 12", Height 16". Shipping wt. 100 lbs. F.O.B. Chicago..... **149.50**

700 WATT—GENERATOR SET—same as above, slightly smaller—with Briggs-Stratton Engine—Model 708—F.O.B. Chicago..... **129.50**

ITEM #2008—2000 WATTS—115 V. A. C. generator set, powered by husky, fast starting Briggs-Stratton engine. Mounted on portable steel carrying base for easy handling—Just right for small cottage and cabins needing the inexpensive 2000 Watts of electricity. Ship. Wt. 190 lbs. F.O.B. Chicago..... **295.00**

BRAND NEW HEAVY DUTY TWO UNIT VICKERS HYDRAULIC PUMP

• For Hydraulic Presses • For Lift Trucks • For Tractors • For Road Machinery

The Vickers model V-2129-FLH is actually two hydraulic pumps on a common shaft. The large pump is rated at 21 G.P.M., 1000 lbs. P.S.I. at 1200 R.P.M. for conventional hydraulic system and the small pump is rated at 3 G.P.M. and 1000 lbs. P.S.I. for power steering or for a second hydraulic system. Rotation counterclockwise. Use them individually or collectively. Dimensions: 18 1/2" Long X 10" in diameter with 1" shaft. 1 1/2" inlet port and 1 1/4" outlet port on large pump. 1" inlet port and 3/4" outlet port on the small pump. Shipping Wt. 66 lbs. Worth \$212.50. Now priced below the value of the smallest pump!! F.O.B. Chicago..... **69.50**

Brand New! 5-TON BLACKHAWK HYDRAULIC LIFT KIT

THE COMPLETE KIT
Now Only **38.95** Complete
For—• Dumping farm wagons • Adjusting depth of plows • Hydraulic press • Hydraulic jack • Snow plows.

KIT CONSISTS OF:
1—Brand new Blackhawk Model P-151—Hydraulic hand pump with built-in oil tank and release valve. Rated from 1200 P.S.I. to 2400 P.S.I. 20" pump. 8"x8"x6" in. Item #82..... **22.50**
1—6 ft. length double walled rubber covered hydraulic hose—tested to 20,000 lbs. Item #278A..... **3.95**
1—Hydraulic Cylinder, 3 1/2" bore, 6" stroke. Husky 3" solid steel shaft. Will lift 10,000 lbs. using pump pressure. Clevis mounting that take 3/4" diameter pins. May be used for double action service. Item #419 \$12.50.
All necessary hydraulic fittings..... **1.90**

COMPLETE KIT PRICE **38.95**
ALL OF ABOVE INCLUDED F.O.B. Chicago



300 AMP. D. C. GENERATORS

IDEAL FOR WELDING GENERATORS
Type R-1 rated 300 Amps, —30 Mid-by General Electric & Ford Government Acqui- Item #91
\$230.00. Ship. wt. 55 lbs. Dimensions: 16"x10"x7". Com-
plete with instructions to convert as Welding F.O.B. Chicago..... **35.00**

ITEM #90—When connected as a welder, this unit will deliver 2000 amps for a sustained period and 250 amps for intermittent service. This generator is widely used for shop-built portable welders. Rated 300 amps, 28 volts, 2500 R.P.M., using 10 H.P. Dimensions: 13 1/2" L. x 6" W. x 8 3/4" H. Spined drive shaft. Gov't. Ship. Wt.: 51 lbs. F.O.B. Chicago..... **22.50**

ITEM #99—12 V.—50 Amps—Leece-Newton generator for autos, trucks, road machinery, boats and battery charges. Precision aircraft quality construction, with life-time grease sealed ball bearings and heavy insulated windings. Standard 4-bolt square mounting flange, spline shaft. Wt. 23 lbs. Gov't. Acq. cost—\$92.00. Now F.O.B. Chicago.... **16.50**

U.S. NAVY ALL BRONZE CENTRIFUGAL PUMP

These all bronze Centrifugal Pumps are ideal for use as marine bilge pumps, circulating pumps, fire protection or irrigation. Car-washing, law-sprinkling, lawn pump, water oil, brine, gasoline, DDT and sulphur compounds. Equipped with 6" adjustable V pulley, 2" dia. inlet and outlet, 180 GPM capacity. Inlet and outlet take with 2 1/2" inside diameter. Dimensions: 11" x 8" x 11".
ITEM #384

| Total head-feet | Speed | H.P. | GPM |
|-----------------|----------|-------|-----|
| 25 | 3600 RPM | 3 | 180 |
| 35 | 3600 RPM | 1 1/2 | 90 |
| 20 | 2400 RPM | 1 1/4 | 75 |

Back plate may be rotated for most convenient inlet position. Gov't acquisition cost \$96.00. Shipping weight 31 lbs. F.O.B. Chicago..... **29.50**

HOBBART 2 H.P. 12-24 VOLT ELECTRIC MOTOR

ITEM #315—Rated 24 Volts D.C., 40 amps, 4000 R.P.M. Has 3/4" spline shaft on both ends of motor, ball bearing construction, as specified for use with electric wheel chair design. Popular Mechanics March issue, 1953. Convertible for use on 6 or 12 volts. Shipping Wt. 21 lbs. Dimensions: 11" x 5" x 6 1/2". F.O.B. Chicago..... **13.00**

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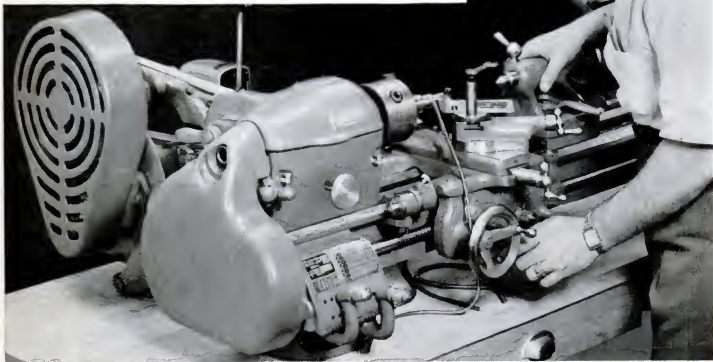
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If there is any one reason why South Bend Lathes are so popular it is because they represent the maximum value per dollar of cost. We invite comparison feature-by-feature with any other make, and are confident you will find South Bend gives you more for your money. Send coupon for catalog.



HARDENED BED WAYS

Hardened and precision ground bed ways can be supplied in lieu of regular at small extra cost—also hardened and ground cross-feed screw.



TIME PAYMENTS

only 3 1/4% interest

Yes, only 3 1/4% interest on original unpaid balance. Low down payment and balance in up to 24 equal monthly payments.



PLEASE SEND INFORMATION CHECKED:



☐ 9" and 10" BENCH LATHES



☐ 10" to 16-24" FLOOR LATHES



☐ DRILL PRESSES



☐ 1/2" & 1" Collet TURRET LATHES



☐ TOOL GRINDERS



☐ 7" BENCH SHAPERS



☐ MILLING MACHINES

Name _____ Street _____
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Building Better Tools Since 1906 • SOUTH BEND LATHE • South Bend 22, Indiana

FOR REPAIRING RADIO AND TV

Superior's New Model 670-A

SUPER METER



A COMBINATION
VOLT-OHM MILLIAMMETER
PLUS CAPACITY REACTANCE
INDUCTANCE AND DECIBEL
MEASUREMENTS

ADDED FEATURE:

Built in ISOLATION TRANSFORMER reduces possibility of burning out meter through misuse.

SPECIFICATIONS:

D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500/7,500 Volts
A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
OUTPUT VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes
RESISTANCE: 0 to 1,000/100,000 Ohms 0 to 10 Megohms
CAPACITY: .001 to 1 Mfd. 1 to 50 Mfd. (Good-Bad scale for checking quality of electrolytic condensers.)
REACTANCE: 50 to 2,500 Ohms 2,500 Ohms to 2.5 Megohms
INDUCTANCE: .15 to 7 Henries 7 to 7,000 Henries
DECIBELS: -6 to +18 +14 to +38 +34 to +58

The Model 670-A comes housed in a rugged crackle-finished steel cabinet complete with test leads and operating instructions.

28⁴⁰

Superior's new streamlined model TC-55

TUBE TESTER



QUICKLY AND EFFICIENTLY TESTS RADIO AND TV TUBES INCLUDING: SEVEN PIN MINIATURES; EIGHT PIN SUBMINIARS, OCTALS AND LOCTALS; NINE PIN NOVALS

YOU CAN'T INSERT A TUBE IN THE WRONG SOCKET. It is impossible to insert the tube in the wrong socket when using the new Model TC-55. Separate sockets are used, one for each type of tube base. If the tube fits in the socket it can be tested.

"FREE-POINT" ELEMENT SWITCHING SYSTEM.

The Model TC-55 incorporates a newly designed element selector switch system which reduces the possibility of obsolescence to an absolute minimum. Any pin may be used as a filament pin and the voltage applied between that pin and any other pin, or even the "top-cap."

CHECKS FOR SHORTS AND LEAKAGES BETWEEN ALL ELEMENTS. The Model TC-55 provides a super sensitive method of checking for shorts and leakages up to 5 Megohms between any one and all of the terminals.

ELEMENTAL SWITCHES ARE NUMBERED IN STRICT ACCORDANCE WITH R.M.A. SPECIFICATION.

One of the most important improvements, we believe, is the fact that the 4 position fast-action snap switches are all numbered in exact accordance with the standard R.M.A. numbering system.

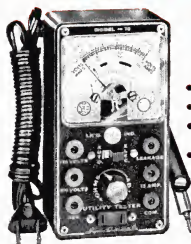
Thus, if the element terminating in pin No. 7 of a tube is under test, button No. 7 is used for that test.

The Model TC-55 comes complete with operating instructions and charts. Use it on the bench—use it in field calls. A streamlined carrying case, included at no extra charge, accommodates the tester and book of instructions.

26⁹⁵

FOR REPAIRING ALL ELECTRICAL APPLIANCES MOTORS AND AUTOMOBILES

Superior's New Model 70 UTILITY TESTER®



As an electrical trouble shooter the Model-70:

- Measures A.C. and D.C. Voltages, A.C. and D.C. Current, Resistances, Leakage, etc.
- Will measure current consumption while the appliance under test is in operation.
- Incorporates a sensitive direct-reading resistance range which will measure all resistances commonly used in electrical appliances, motors, etc.
- Leakage detecting circuit will indicate continuity from zero ohms to 5 megohms (5,000,000 ohms).
- Will test Toasters, Irons, Boilers, Heating Pads, Clocks, Fans, Vacuum Cleaners, Refrigerators, Lamps, Fluorescents, Fans, Switches, Thermostats, etc.

Handsome round-cornered molded bakelite case, 3 1/4" x 5 1/2" x 3 1/4". Complete with all test leads. Also included is a 64 page book giving detailed instructions for testing all electrical appliances, automotive equipment, etc.

As an Automotive Tester the Model 70 will test:

- Both 6 Volt and 12 Volt Storage Batteries
- Generators
- Starters
- Distributors
- Ignition Coils
- Regulators
- Relays
- Circuit Breakers
- Cigarette Lighters
- Stop Lights
- Condensers
- Directional Signal Systems
- All Lamps and Bulbs
- Fuses
- Heating Systems
- Horns
- Also will locate poor grounds, breaks in wiring, poor connections, etc.

15⁸⁵

SHIPPED ON APPROVAL NO MONEY WITH ORDER — NO C.O.D.

Try any of the above instruments for 10 days before you buy. If completely satisfied then send down payment and balance as indicated on coupon. No interest or finance charges added! If not completely satisfied return unit to us, no explanation necessary.

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. D-301, 3849 Tenth Ave., N. Y. 34, N. Y.

Please send me the units checked. I agree to pay down payment within 10 days and to pay the monthly balance as shown. It is understood there will be no finance or interest charges added. It is further understood that should I fail to make payments when due, the full unpaid balance shall become immediately due and payable.

☐ Model 70 . . . Total \$15.85
\$3.85 within 10 days. Balance \$4.00 monthly for 3 months.

☐ Model 670-A. Total \$28.40
\$7.40 within 10 days. Balance \$3.50 monthly for 6 months.

☐ Model TC-55. Total \$26.95
\$6.95 within 10 days. Balance \$5.00 monthly for 4 months.

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All Prices Net, F.O.B., N.Y.C.

Trend setting glimpse of tomorrow... the Magnificent

Lark 57

DREAM STUFF? Call it that. But what a *practical* dream... to pleasure-power your *own* new boat with such commanding drive and speed and stunning modern beauty! *Any smart hull*... forwardly-styled "dream boat" or able cruiser, family runabout or sport fisherman...

... receives a noble lift when a Lark goes on the transom. Under the hood purrs a brawny new engine—muscle and tuned for the real jobs of boating—35 *big-hood* horsepower! For fast, sure starts there's a new 12-volt system. For cruiser lighting a new heavy-duty generating system is available, with capacity to keep batteries charged at peak. The Lark is *here*—at your Evinrude dealer's *moor*. Look for his name under "Evinrude Motors" in your phone book. For full-color catalog of the complete Evinrude line for '57, write **EVINRUDE MOTORS**, 4336 N. 27th St., Milwaukee 16, Wisconsin.

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